Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

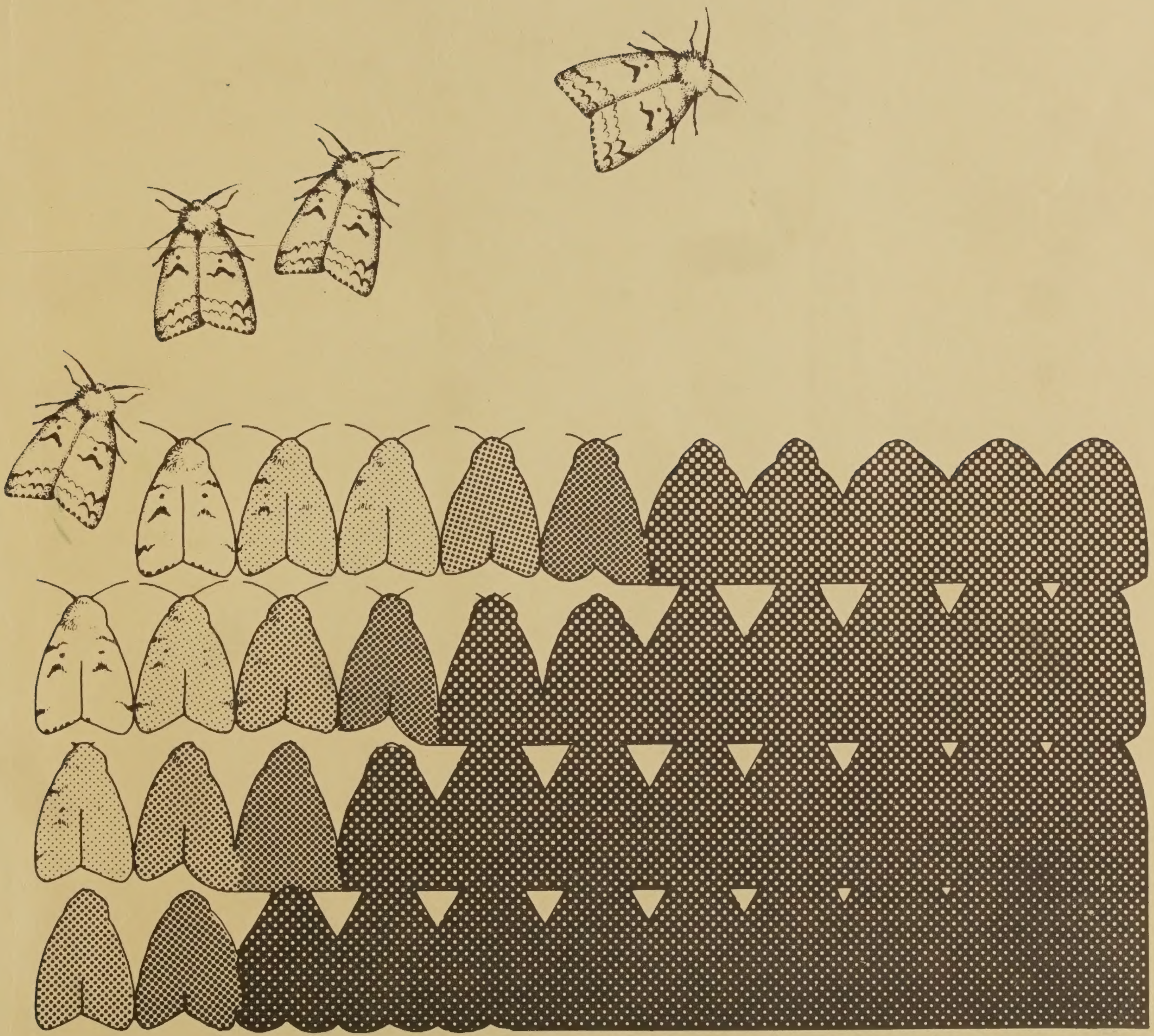
United States
Department of
Agriculture

Forest Service

Animal and Plant
Health Inspection
Service

Gypsy Moth Suppression and Eradication Projects

Final Environmental Impact Statement



Final Environmental Impact Statement
USDA Gypsy Moth Suppression and Eradication Projects
Prepared in Accordance with Section 102(C) of NEPA

Lead Agencies:

USDA Forest Service
P. O. Box 2417
Washington, DC 20013

USDA Animal and Plant
Health Inspection Service
Washington, DC 20250

Responsible Officials:

<u>Suppression Projects</u>

R. Max Peterson, Chief
USDA Forest Service
P. O. Box 2417
Washington, DC 20013

<u>Eradication Projects</u>

Bert Hawkins, Administrator
USDA Animal and Plant
Health Inspection Service
Washington, DC 20250

For further information contact:

<u>Suppression Projects</u>

Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008
Phone: 215-461-3125

<u>Eradication Projects</u>

Robert L. Williamson, Director
National Program Planning Staff
USDA Animal and Plant Health
Inspection Service
Federal Building
Hyattsville, MD 20782
Phone: 301-436-8261

Abstract: This Final Environmental Impact Statement (FEIS) describes the proposed USDA Forest Service and Animal and Plant Health Inspection Service (APHIS) gypsy moth suppression and eradication projects in cooperation with State and Federal agencies. Four alternatives incuding a "no-action" alternative, are described. The environmental effects of implementing each of the proposed alternatives are discussed. The alternative selected by USDA Forest Service and APHIS is Integrated Pest Management integrating the use of chemical and biological insecticides, and other operational technologies to suppress or eradicate gypsy moth infestations throughout the United States. Annual requests by cooperating State and Federal agencies for USDA Forest Service financial assistance will be considered on an individual basis. Annual decisions concerning USDA Forest Service participation in suppression projects and APHIS participation in eradication projects will be based on the results of site-specific environmental analyses conducted in accordance with NEPA.

Date of transmission to EPA and the public: March 16, 1984.

Draft: ______ Final: <u>X</u>

SUMMARY

FINAL ENVIRONMENTAL IMPACT STATEMENT

USDA GYPSY MOTH SUPPRESSION AND ERADICATION PROJECTS

Purpose of and Need for Action

Since its accidental release in the United States in 1869, gypsy moth has spread throughout New England and areas to the south and west, and is now permanently established in all or parts of 14 States. Most recent additions include the eastern panhandle of West Virginia and northwestern Virginia. The gypsy moth has caused severe tree defoliation on more than 52 million acres since 1924, with 55 percent of that total or 28 million acres occurring during the period 1980-83. Single- year defoliation records were reported in 1980 (5.1 million acres) and 1981 (12.8 million acres). Individual State defoliation records were reported in 9 States in 1981. Defoliation by the gypsy moth subsided slightly to 8.1 million acres in 1982, and 2.3 million acres in 1983. This 2.3 million acre total is still the 4th highest defoliation since records have been maintained. Although defoliation decreased over most of the Northeast in these years, insect activity increased along the leading edge of the areas infested as the gypsy moth continued its spread in Maryland, Delaware, southern and western portions of Pennsylvania, and in an earlier established isolated infestation in central Michigan.

An increase in the number of isolated infestations resulting from the artificial movement of gypsy moth life stages to areas outside of the generally infested areas has occurred in association with the recent gypsy moth outbreak in the Northeast. In 1981, isolated infestations were treated in 9 States as far west as California. In 1982, 38 isolated infestations were treated in 14 States. In 1983, eradication treatments were applied at 37 locations in 12 States. At present, known isolated infestations of gypsy moth outside of the previously-mentioned generally infested areas occur in 13 States from the mid-Atlantic States and Great Lakes Region, to the West Coast.

The gypsy moth has caused dramatic economic impacts in the generally infested areas. In the 1980 report to Congress, USDA estimated losses to homeowners, forest industries, and recreation areas at $272 million. Timber losses alone in 1981 were estimated at $72 million. Timber losses in Pennsylvania from 1970-79 were $36 million, while

one State Forest in New Jersey experienced a $3 million timber loss as a result of 1979-80 gypsy moth infestations. Significant economic impacts are predicted outside of the generally infested area if isolated infestations become permanently established. A recent study conducted for the State of California predicts urban, agricultural, and forestry losses ranging between $446 million and $457 million for the period 1982 to 1999, assuming that gypsy moth infestations in the State are not treated.

Major Issues and Concerns

Major issues and concerns were identified during scoping activities. In addition, a 1983 court decision (Oregon Environmental Council vs. Kunzman et al. CA No. 82-3232, DC No. CV82-504) amplified some of these same issues.

Major issues, concerns, and opportunities identified during this entire process were: concern for human health; a need for more public education regarding gypsy moth suppression and regulatory programs; a need for increased public involvement in selection of insecticides and treatment areas; concern for the environmental effects of using insecticides; a need for discussion of alternatives to chemical insecticides; a need for continued Federal/State coordinated gypsy moth suppression and eradication projects; a need for improved and continuous communications between project coordinators regarding safety; and a need to update future National Environmental Policy Act (NEPA) documents with new information on registered insecticides such as label changes, new insecticides, and environmental monitoring.

Alternatives Including Proposed Action

Alternatives considered for USDA gypsy moth suppression and eradication projects on Federal and non-Federal lands are:

(1) No action.

(2) Chemical insecticide treatment.

(3) Biological insecticide treatment.

(4) IPM approach (selected).

The no action alternative would result in no USDA-funded suppression or eradication projects. Technical assistance would be provided by USDA if requested. The no action alternative would not

preclude financing and implementation of suppression and eradication projects by individual States, counties, or private citizens.

The chemical insecticide treatment alternative would result in funding of proposals to use chemical insecticides such as carbaryl, trichlorfon, diflubenzuron, and acephate. These chemical insecticides have successfully achieved the desired project objectives in previous suppression and eradication projects and are registered by the U. S. Environmental Protection Agency (EPA) for application against the gypsy moth. Currently, none of these chemical insecticides are under review for suspected health or environmental hazard posed by their registered uses according to generally accepted application practices.

The biological insecticide treatment alternative would result in funding of proposals to use biological insecticides. The biological insecticides registered by the EPA for gypsy moth suppression are formulations of *Bacillus thuringiensis* (*B. t.*) and the gypsy moth nucleopolyhedrosis virus (NPV).

The IPM approach would result in funding of IPM strategies for gypsy moth suppression and eradication. The components of this strategy include biological and/or chemical insecticide application, parasite and predator management, application of the gypsy moth pheromone, release of sterile or partially sterile gypsy moth life stages, and forest stand manipulation. Currently, only use of the biological and chemical insecticides and the gypsy moth pheromone are considered operationally viable gypsy moth suppression or eradication components.

Affected Environment

Gypsy moth is permanently established in all or portions of Connecticut, Delaware, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. Natural spread of the insect will likely continue southerly and westerly to adjacent States. Localized isolated infestations presently occur in California, Illinois, Indiana, Michigan, Minnesota, North Carolina, Ohio, Oregon, South Carolina, Tennessee, Virginia, Washington, and Wisconsin. Artificial movement of gypsy moth life stages from the generally infested areas will

continue to cause establishment of isolated infestations in these and other States where suitable host material exists; however, regulation of articles contributing to this movement will reduce such occurrences.

The areas now experiencing and those susceptible to gypsy moth are not homogenous in terms of physical, biological, economic or social attributes. Therefore, specific identification and discussion of the affected environment will be addressed in site- specific environmental analyses for proposed suppression and eradication projects.

Environmental Consequences

The no action alternative would not necessarily eliminate gypsy moth suppression or eradication activities. Nontarget organisms will not be adversely affected. Gypsy moth parasite and predator populations may increase to levels exerting some biological control of localized gypsy moth populations. If the no action alternative were implemented outside of currently regulated areas of the country, Federal and State quarantines would be imposed to limit artificial spread from these areas. If State and other Federal agencies or individuals implement their own suppression or eradication activities, the biological and physical effects would depend on the method used. Untreated infestations on Federal lands could adversely affect suppression and eradication efforts by non-Federal landowners on adjacent land. If no action is taken by State agencies or individuals, there would be no immediate impact on the physical environment except that caused by the presence of the gypsy moth. Suppression projects undertaken without State coordination may not provide for adequate public involvement and notification of property owners adjacent to those residences conducting suppression or eradication activities. This could result in the application of more or less insecticide than is necessary to suppress or eradicate gypsy moth populations either of which could result in unnecessary adverse environmental effects.

Implementation of the chemical insecticide treatment alternative will, in the year of treatment, reduce gypsy moth populations, reduce larval nuisance, protect foliage, and prevent excessive tree mortality. The application of chemical insecticides will reduce populations of nontarget insects, including some beneficial

insects. Diflubenzuron is toxic to some aquatic organisms. Carbaryl is toxic to honeybees, some aquatic insects, and shellfish. Acephate is toxic to some nontarget organisms and honeybees immediately after treatment. Trichlorfon is toxic to flies, including some gypsy moth parasites. These insecticides will be applied in accordance with EPA-approved label directions. The registered use of chemical insecticides, as applied to treatment areas during gypsy moth suppression and eradication projects, will have no adverse effect on fish, wildlife, livestock, and domestic animals. There appears to be no substantiated medical evidence showing that the chemical insecticides as used in gypsy moth suppression or eradication projects have a significant adverse impact on human health when used in compliance with the pesticide label, except in isolated circumstances where individuals exhibit extreme sensitivity to pesticides or other chemical or environmental substances. Estimated exposure levels to the general public, resulting from the planned application rates in gypsy moth projects, are below established exposure threshold levels. Chemical insecticides used for gypsy moth suppression and eradication projects have a relatively short residual life in soil and water. Implementation of the chemical insecticide treatment alternative will not result in any irreversible or irretrievable adverse environmental impacts.

Implementation of the biological insecticide treatment alternative can be expected to provide foliage protection, population reduction, and have no adverse effect on nontarget organisms, except some lepidopterous larvae. The only biological insecticide currently available for gypsy moth suppression and eradication are formulations of *B. t.* There will not be a direct loss of existing parasite or predator populations in areas treated with *B. t.*; however, some nontarget lepidopterous larvae may be affected. Recently, single applications of *B. t.* have demonstrated effectiveness in suppression projects; however, multiple applications of *B. t.* (2 or more) may be required to achieve project objectives in some areas where gypsy moth populations are extremely high or where eradication is the goal. The biological insecticide derived from the gypsy moth nucleopolyhedrosis virus (NPV), although registered for use, has not demonstrated the consistent efficacy required for operational use.

Although the biological insecticides can provide foliage protection, larval mortality does not occur rapidly. Consequently, larval nuisance and tree defoliation are likely to continue for several weeks after application. Implementation of the biological insecticide treatment alternative will not result in irreversible or irretrievable adverse environmental impacts.

Implementation of the IPM alternative would result in the use of biological and/or chemical insecticides, the gypsy moth mating disruption pheromone, and other operationally available suppression and eradication methods in an integrated approach. The biological effects of the IPM alternative will depend on the extent to which the various components are implemented. The IPM approach encourages the selection of either biological and chemical insecticides or other control methods commensurate with treatment needs and land management objectives. In terms of foliage protection and population reduction, the IPM alternative may result in a greater degree of tree defoliation and/or higher gypsy moth population in some areas than may be realized under the chemical insecticide and/or biological alternatives. In some situations, quarantines may be necessary to limit artificial spread from such areas. Economic efficiency for IPM may be less than for the chemical and/or biological insecticide alternatives depending on the extent to which various IPM components are implemented.

Consultation with Others

In accordance with NEPA regulations, the Draft Environmental Impact Statement was sent for public review and comment to a variety of agencies, organizations, and individuals. Written comments were received from the following agencies and individuals:

Federal Emergency Management Agency
U.S. Department of the Interior
U.S. Environmental Protection Agency
Alabama Department of Economic and Community Affairs
California Department of Food and Agriculture
Department of Health & Human Services - Atlanta, GA
Georgia State Clearinghouse
Kentucky Department of Agriculture
Kentucky Natural Resources and Environmental Protection Cabinet
Maryland Department of Planning

Missouri Office of Administration
New Jersey Coalition for Alternatives to Pesticides
New York State College of Agriculture and Life Sciences - Cornell University
Oregon Executive Department
Oregon State Clearinghouse
Tennessee Department of Agriculture
The Resources Agency of California
Washington Department of Agriculture
Audubon Naturalist Society of the Central Atlantic States, Inc.
Highlands Watershed Association - West Milford, NJ
Western Washington Toxics Coalition - Seattle, WA
Citizens for a Better Environment - San Francisco, CA
Friends of the Earth - Seattle, WA
Sierra Club - Atlantic Chapter
Bricklin & Gendler
Hammermill Paper Company
The Proctor and Gamble Paper Products Company
Jeffrey L. Coleman - Morris Plains, NJ
Helen V. Moore - Raleigh, NC
Janet G. and Kenneth S. Nolley - Salem, OR
Elaine M. and Glen E. Olsen - Salem, OR
Daniel F. Read - Raleigh, NC

*Letters received too late for comment:

*U.S. Department of the Interior
*Commonwealth of Virginia - Council on the Environment
*Iowa Office for Planning and Programming
*Ohio State Clearinghouse
*Tennessee State Planning Office
*Washington Department of Ecology
*Northwest Coalition for Alternatives to Pesticides
*Urban Pesticides Resource Center - Spring City, PA

The Final Environmental Impact Statement was submitted to the U.S. Environmental Protection Agency (EPA) and will be made available to interested persons on March 16, 1984.

TABLE OF CONTENTS

Page

LIST OF TABLES AND FIGURES

INTRODUCTION

This Final Environmental Impact Statement (FEIS) describes four alternatives developed by USDA Forest Service (FS) and Animal Plant Health Inspection Service (APHIS) for suppressing or eradicating gypsy moth infestations on Federal and non-Federal land in cooperation with State and Federal agencies. The alternatives are evaluated and the preferred action is identified. The alternative implemented will guide USDA participation in gypsy moth suppression and eradication projects. When new insecticides, technology, or application methods are developed, or when environmental analyses identify unreasonable adverse effects to human health or the environment, appropriate action will be taken.

Decisions concerning USDA Forest Service and APHIS participation in suppression and eradication activities will be based on the results of site-specific environmental analyses conducted in accordance with the National Environmental Policy Act (NEPA).

PURPOSE AND NEED FOR ACTION

BACKGROUND

The Situation

The gypsy moth, Lymantria dispar L., is native to many areas of Europe, Asia, and Africa. This insect was accidentally released in the United States in 1869 in Massachusetts. In 1924, only 3 States reported the presence of gypsy moth defoliation; however, by 1983 gypsy moth defoliation had been reported in 12 States. Of concern is the total cumulative defoliation recorded since 1924 (52 million acres), particularly the recent rapid increases as depicted in the following tabulation:

Period	Total Defoliation (acres)	Percent of Cumulative Total
1924-69	11,955,486	23
1970-79	11,640,705	22
1980-83	28,432,673	55

A summary of gypsy moth-caused defoliation by State from 1924 to 1983 is presented in Table 1.

The current gypsy moth outbreak began in 1980 when more than 5 million acres were defoliated in the Northeastern States and Michigan. This represented a record in defoliated acres, more than 2.5 times the previous high total observed in 1971. Gypsy moth activity increased dramatically in 1981 and caused tree defoliation on more than 12.8 million acres. New State defoliation records were reported that year in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Jersey, New Hampshire, Pennsylvania, and Rhode Island. Insect activity declined slightly in 1982, causing defoliation on 8.1 million acres. Although defoliation levels decreased over most of the Northeast that year, insect activity was particularly brisk along the leading edge of the infestation as the gypsy moth continued its spread in Maryland, Delaware, southern and western portions of Pennsylvania, and in an earlier established infestation in central Michigan.

An apparent natural collapse of gypsy moth populations began throughout much of the Northeast in 1983 as defoliation levels dipped to slightly more than 2.3 million acres (the 4th highest level of defoliation recorded). The insect, however, accelerated its activity in Maryland, Delaware, and central Michigan with all three States reporting record levels of defoliation.

Table 1. Summary of gypsy moth-caused defoliation (acres) by State, 1924-1983.

Year	ME	NH	VT	MA	RI	CT	NY	PA	NJ	DE	MD	MI	Total
	-----	-----	-----	-----	-----	-----	acres	-----	-----	-----	-----	-----	-----
1924	71	591	-	163	-	-	-	-	-	-	-	-	825
1925	-	239	-	48,321	-	-	-	-	-	-	-	-	48,560
1926	1	960	5	78,193	1,663	-	-	-	-	-	-	-	80,822
1927	4,985	3,923	2	131,880	126	4	-	-	-	-	-	-	140,920
1928	5,575	119,757	3	137,121	58	-	-	-	-	-	-	-	262,514
1929	15,187	440,845	-	95,078	23	-	-	-	-	-	-	-	551,133
1930	55,174	205,125	-	27,856	66	5	-	-	-	-	-	-	288,226
1931	20,938	96,690	277	86,694	114	8	-	-	-	-	-	-	204,721
1932	42,298	43,287	1	200,387	376	46	-	-	-	-	-	-	286,395
1933	19,718	216,669	2	157,003	4,292	46	-	-	-	-	-	-	397,730
1934	60,403	285,880	25	128,237	17,750	66	-	-	-	-	-	-	492,361
1935	92,630	330,195	106	106,097	10,908	833	-	-	-	-	-	-	540,769
1936	80,944	192,114	-	152,469	3,095	-	-	-	-	-	-	-	428,622
1937	140,026	72,973	81	393,613	2,063	4	-	-	-	-	-	-	608,760
1938	120,432	34,122	416	154,348	3,297	1,339	-	-	-	-	-	-	313,954
1939	202,193	136,772	5,311	143,292	848	4,224	-	-	-	-	-	-	492,640
1940	204,041	152,797	3,160	125,586	52	-	-	-	-	-	-	-	485,636
1941	122,386	80,579	980	263,369	707	-	-	-	-	-	-	-	468,021
1942	850	6,963	49	36,715	-	-	-	-	-	-	-	-	44,577
1943	10	290	-	34,481	64	-	-	-	-	-	-	-	34,845
1944	21,221	2,346	210	225,637	640	14	75	6	-	-	-	-	250,149
1945	210,881	58,517	93,950	456,832	1,280	16	-	11	-	-	-	-	821,487
1946	203,813	183,943	15,900	217,132	1,645	486	-	-	-	-	-	-	622,919
1947	-	166	-	7,256	-	-	-	-	-	-	-	-	7,422
1948	60	21	-	32,386	-	-	-	-	-	-	-	-	32,467
1949	-	8	-	78,665	-	-	-	-	-	-	-	-	78,673
1950	2	12	-	4,979	-	375	-	-	-	-	-	-	5,368
1951	8,195	2,478	1,108	3,185	-	5,673	675	-	-	-	-	-	21,314
1952	82,715	94,975	26,985	82,372	-	6,005	-	-	-	-	-	-	293,052
1953	174,999	209,335	120,787	917,996	-	56,215	7,745	-	-	-	-	-	1,487,077
1954	170,485	154,015	24,650	118,095	-	13,848	10,355	-	-	-	-	-	491,448
1955	10,810	14,975	8,875	-	-	6,842	10,559	-	-	-	-	-	52,061
1956	7,285	9,305	12,635	3,830	-	3,458	6,645	-	-	-	-	-	43,158
1957	120	-	495	16	-	4,909	858	60	-	-	-	-	6,458
1958	-	-	-	8	-	117	-	-	-	-	-	-	125
1959	1,000	4,000	1,500	382	-	5,980	1,605	-	-	-	-	-	14,467
1960	6,350	4,600	6,132	150	-	15,000	16,490	-	-	-	-	-	48,722
1961	21,340	621	11,834	3,000	-	-	30,685	-	-	-	-	-	67,480
1962	3,998	3,390	6,292	150,000	-	83,290	61,342	-	-	-	-	-	308,312
1963	1,970	8,345	12,020	87,847	-	40,140	22,600	-	-	-	-	-	172,922
1964	-	14,509	23,523	20,787	375	98,552	97,237	-	-	-	-	-	254,983
1965	190	8,451	2,903	17,232	50	86,009	148,366	-	-	-	-	-	263,201
1966	30	20	650	500	110	15,895	34,655	-	5	-	-	-	51,865
1967	825	561	2	909	150	2,731	46,160	-	1,035	-	-	-	52,373
1968	777	5,830	-	3,925	565	16,416	47,525	60	5,025	-	-	-	80,123
1969	1,450	17,160	-	6,060	313	56,881	121,610	830	51,525	-	-	-	255,829
1970	1,080	38,525	-	6,835	1,082	368,706	416,270	10,500	129,835	-	-	-	972,833
1971	820	3,250	790	18,787	8,525	655,107	479,150	598,200	180,595	-	-	-	1,945,224
1972	40	200	4,215	20,480	22,510	513,880	177,605	404,060	226,140	-	-	-	1,369,130
1973	490	30	200	43,970	35,925	333,215	248,441	856,710	254,865	-	-	-	1,773,846
1974	860	-	-	76,903	2,120	120,980	42,350	479,590	28,102	-	-	-	750,905
1975	110	-	15	17,895	435	63,411	9,275	317,880	55,430	-	-	-	464,451
1976	-	-	1,750	29,820	7,540	9,809	26,583	732,310	57,630	-	-	-	865,442
1977	2,010	320	33,435	133,081	125	-	91,313	1,296,550	39,185	-	-	-	1,596,019
1978	4,120	725	29,756	63,042	-	3,835	500,046	452,892	204,830	-	-	-	1,259,246
1979	23,180	5,980	15,411	226,260	655	7,486	162,275	8,552	193,700	10	-	100	643,609
1980	221,220	183,999	75,094	907,075	43,830	272,213	2,449,475	440,500	411,975	-	3	5	5,005,389
1981	655,841	1,947,236	48,979	2,826,095	272,556	1,482,216	2,303,915	2,527,753	798,790	500	8,826	18	12,872,725
1982	574,537	878,273	9,864	1,383,265	658,000	803,802	825,629	2,351,317	675,985	1,265	9,162	92	8,171,191
1983	16,285	560	-	148,133	53,880	153,239	290,843	1,360,824	340,285	2,992	15,870	457	2,383,368
Total	3,616,971	6,277,452	600,378	10,841,725	1,157,813	5,313,326	8,688,357	11,838,605	3,654,937	4,767	33,861	672	52,028,864

History of Gypsy Moth Control 1/

Gypsy moth control activities have been cyclical due to the periodic increases and decreases in the gypsy moth population. Control activities have traditionally involved Federal, State, county, and local government as well as private citizens.

Inconspicuous during the first 20 years after its introduction, gypsy moth populations exploded in 1889, threatening to overrun Medford, Massachusetts. Unable to deal with the situation, local officials appealed for State assistance. The Commonwealth responded quickly and appropriated funds for control activities and for a permanent commission to carry out the work. Soon thereafter, Gypsy Moth Commissioners met with mayors of affected towns, scientists, and officials from the USDA Division of Entomology to seek advice on long-range goals and tactics. Largely at USDA urging, a policy of eradication was implemented.

The first recorded use of a chemical to control gypsy moth occurred as part of the Massachusetts eradication effort. The material was an arsenical, Paris green (Forbush and Fernald 1896). The treatment of infested trees and other foliage with Paris green was supplemented by applications of creosote to egg masses, burning of infested trees, shrubbery, and clusters of caterpillars, and banding of trees with burlap and sticky materials to either trap the larvae or prevent their ascent of the trees.

The technology of insecticide application lagged far behind scientific understanding of the problem; machines designed for spraying orchards bogged down in the rough, hilly forest terrain. By the end of the 1891 field season it was evident that Paris green could not be used to eradicate the gypsy moth. Besides poor efficacy, Paris green was often phytotoxic and was easily washed off foliage (Kirkland 1905). The inadequacies of Paris green also generated adverse public reaction.

Once again the Gypsy Moth Commission was forced to turn to the expensive and time consuming methods of gathering egg masses and using traps and sticky bands to stop the larvae. Experimental work on new insecticides continued and, while an effective eradication material was not available in 1892, bromine and chlorine were found to be useful in

---

1/ Major sources of this section: USDA 1981a; Dunlap 1980.

destroying egg masses in hollow trees. In 1893, a new compound, lead arsenate, proved effective in the field (Forbush and Fernald 1896). For the next 50 years, this material was the standard insecticide used the Northeast for gypsy moth control.

In 1900, funds were not appropriated by the Massachusetts legislature for the Gypsy Moth Commission and the first gypsy moth campaign ended. In the succeeding years, gypsy moth populations increased such that during the summer of 1905, insect conditions in Medford, Massachusetts, and surrounding towns were similar to those in 1889.

By 1905, the gypsy moth had spread to other States in New England, making an eradication policy impossible with the insecticides and application methodology available at the time. At this point, the USDA Bureau of Entomology became involved in gypsy moth control activities.

In this second campaign, Federal and State officials looked toward biological control, that is, the use of parasites and predators to keep gypsy moth populations below damaging levels. The USDA funded programs to import and establish natural enemies of gypsy moth from Europe, and States enthusiastically supported the European parasite expeditions. Expectations ran so high that some officials predicted that the biological program would control gypsy moth within 2 to 3 years.

By 1908, however, scientists were having doubts about biological control as an immediate and economical method to control gypsy moth populations. The establishment of gypsy moth parasites and predators was proving more difficult and expensive than had been anticipated. Little was known about the biology and habits of these insects and most parasites did not survive in the new environment. Even though some parasites were parasitizing gypsy moth, the effect was not noticeable.

Biological control eventually did prove somewhat successful. By the 1920's, parasites and predators were having an effect on gypsy moth populations--but not to the extent of providing relief from defoliation and the nuisance of larvae as originally expected. Biological control work slowed after 1911 and continued at a reduced rate until World War I and for a few years beyond.

After 1911, State and Federal agencies fell back to a selective approach, treating areas such as roadsides, parks and town-areas where gypsy moth damage would be visible. In 1922, the gypsy moth reached New York and a barrier zone along the Hudson River was established to confine the insect to New England. A strenuous attempt was made to eradicate isolated infestations outside the barrier zone.

During this period the most important control techniques involved the use of insecticides, mainly lead arsenate. The popularity of insecticides was due to many factors. First was the public's desire for a immediate solution to high, damaging gypsy moth population levels. Second, insecticides could be used without much advance planning and they had immediate, visible results. Finally, they could be used by individuals or towns without a need to coordinate activities. Chemical insecticides and improved application equipment made roadside and urban spraying economical and practical.

The barrier zone policy continued until 1938 when a hurricane apparently facilitated the spread of the gypsy moth. In the early 1940's, eradication of the gypsy moth in New England was all but abandoned, primarily because lead arsenate and existing equipment were inadequate for large-scale control efforts.

The New York barrier zone was established in part to slow the spread of gypsy moth until new control techniques and methodologies could be developed. In 1939, the insecticidal properties of a synthetic organic chemical, dichloro-diphenyl-trichloroethane (DDT), were discovered.

DDT acted as both a contact and a stomach poison; larvae not killed by contact soon succumbed following ingestion of treated foliage. Less than a pound of DDT per acre killed almost all of the larvae. Soon after DDT was available for general use, USDA officials considered ideas of complete gypsy moth eradication--the first revival of that idea since the turn of the century. By 1956 Federal and State officials had formulated an eradication plan. The first phase involved aerial application of DDT to eliminate outlying gypsy moth infestations in New York, Pennsylvania, and Michigan. The second phase would involve treatment of gypsy moth infestations in New England. At its peak use in 1957, more than 2

million acres of forest and forested communities were treated with DDT. During the period of its use, DDT was applied to more than 12 million acres of forest in 9 Northeastern States and Michigan for gypsy moth control (EPA 1975).

In the late 1950's and early 1960's, a growing public concern developed over the use of DDT. The material was being described as a "dangerous substance which killed beneficial insects, upset the natural ecological balance and collected in the food chain, thus posing a hazard to man, and other forms of advanced aquatic and avian life" (EPA 1975). Beginning in 1958, DDT was phased out of USDA cooperative gypsy moth suppression projects. In 1972, the EPA cancelled most uses of DDT.

Since the 1950's, there has been an increase in the research and development of new insecticides. In 1958, a new material, carbaryl, under the trade name Sevin®, was introduced to replace DDT as the primary agent to control the gypsy moth. Although carbaryl has a much shorter half-life and is generally considered much safer than DDT, the material in certain formulations is highly toxic to honeybees. During the period from 1962 to 1977, almost 2 million pounds of this material were used by Federal and State agencies against the gypsy moth in the Northeastern United States.

In the late 1960's, an organophosphate, trichlorfon, registered under the name of Dylox®, proved efficacious against the gypsy moth. By the early 1970's, 2 formulations of Dylox had been used in operational gypsy moth programs. During the 1970's, another organophosphate, acephate (Orthene®) and an insect growth regulator, diflubenzuron (Dimilin®), were registered. Additional chemicals such as malathion, methoxychlor, and phosmet are registered for gypsy moth control, but they are not generally used in Federal/State suppression or eradication projects.

Insecticide research and development in recent years has not been limited to chemicals. During the 1950's, USDA began development on a bacterium that affects many lepidopterous species. This bacterium, *Bacillus thuringiensis* (*B. t.*) is currently registered and available under a variety of trade names. During the 1960's, the USDA Forest Service began investigations of a nucleopolyhedrosis virus (NPV) that causes a wilt disease primarily in heavy gypsy moth populations.

This virus product was refined in the 1970's and registered in 1978. It is currently undergoing field testing and is not considered ready for operational use at this time. Also in the 1970's, the USDA successfully isolated and synthesized the sex attractant emitted by female gypsy moths. This material, called disparlure, has been used almost exclusively as a detection tool for locating isolated gypsy moth infestations outside of the Northeast. Development and evaluation of the material to confuse male moths and disrupt mating is currently being conducted by Federal agencies and private industry.

Gypsy moth suppression activities have evolved from State-administered projects like those in Massachusetts in the 1890's, to current Federal/State coordinated projects. The failure of earlier policies to check the natural spread of gypsy moth caused pest managers and private citizens during the 1950's to no longer attempt eradication of the insect in the Northeast. Although gypsy moth eradication is still the goal in isolated infestations, strategies are tailored to fit the particular situation in an Integrated Pest Management (IPM) approach.

An IPM approach is possible today because of the different treatments and methodologies now available or soon to be operational. These include more refined survey methods and ability to predict population buildups and subsequent impacts. The existence of several chemical and biological insecticides allows pest managers flexibility in selecting tactics that are most effective and that have a minimal impact on the environment. As an integral part, an IPM strategy also provides for more public involvement in the selection of treatment areas and tactics.

Major Issues and Concerns

The general buildup of gypsy moth populations has focused public attention on efforts to suppress infestations and regulate spread. Major concerns of State agencies responsible for gypsy moth management and other Federal landowners are the impacts of establishment of isolated infestations, larval nuisance, tree defoliation, and tree mortality.

In developing this FEIS for gypsy moth suppression and eradication, the USDA Forest Service and APHIS sent letters to Federal, State and local agencies, private industry, environmental and related private organizations, and interested individuals

(Appendix A). These groups and individuals were asked to identify relevant issues and concerns. In addition, a 1983 court decision (Oregon Environmental Council vs. Kunzman et al, CA No. 82-3232, DC No. CV 82-504) amplified some of these same issues. The major issues and concerns identified through the public scoping process and the court cases, beginning with those most frequently mentioned, are:

(1) Human health. Concerns were expressed regarding the aerial application of chemical and biological insecticides to communities and adjacent populated areas in relation to direct and indirect contamination of drinking water, wells, watersheds, and garden crops. Also expressed were the potential health risks from direct and indirect human (including children and sensitive persons) exposure to insecticides, specifically with regard to the supposedly carcinogenic effects of nitrosocarbaryl, and allergies to chemical insecticides. Concerns expressed in support for suppression of the insect were related to potential allergic reactions from contact with larval hairs, larval excrement, and moth wing scales. Effects of insecticide applications on forest lands as opposed to lands without tree cover needs to be discussed.

(2) Public education. Participants expressed a need for increased education in the form of publications, newspaper articles, and films that present the gypsy moth problem in an unbiased manner; additional publications on homeowner self-help techniques and the current status of new techniques; increased use of biological insecticide and parasites; and case studies on the long-term effects of gypsy moth-caused defoliation. In addition, respondents felt that a description of treatment areas and discussion of treatment techniques used in USDA suppression and eradication projects was necessary.

(3) Public involvement and notification. Respondents indicated a need for local involvement in the determination of project criteria and procedures based on State and local meetings and guidance; the need for improved and continuous communications between State, local, and community coordinators and the public regarding areas

planned for treatment, treatment dates, cancellation of treatments, and rescheduled dates; and an explanation of plans to ensure public safety. A need also was expressed for the identification of officials responsible for administering suppression or eradication projects and those available to the public to provide other project information.

(4) Environmental effects. Concern was expressed regarding the need to use short residual insecticides and on the effect of insecticides on gypsy moth parasites, predators, honey bees, aquatic insects, and wildlife.

(5) Alternatives to chemical insecticides (New Technologies). Respondents expressed the desire for a discussion of alternatives to chemical insecticides such as the increased use of biological insecticides, homeowner self-help techniques, parasites and predators, and of the effectiveness and long-term benefits of these alternatives.

(6) Availability of past and current Environmental Impact Statements. Some people did not know where to obtain copies of past and current Environmental Impact Statements. A mechanism needs to be developed whereby documents can readily be obtained.

(7) Label interpretation. Participants expressed a need to update Environmental Impact Statements with information on registered insecticides, label changes, new insecticides, monitoring, and human health studies.

(8) Project administration. Requests were made for a more coordinated approach between the USDA Forest Service, APHIS, and cooperating State agencies, a new funding arrangement for cooperative suppression favoring increased application of biologicals over the chemical insecticides, and increased emphasis on IPM.

(9) Federal involvement. Most participants favored State and Federal involvement in cooperative suppression and eradication projects to provide for coordinated projects using registered insecticides applied under optimum weather conditions with proper application timing.

These issues and concerns were used to guide the environmental analysis documented in this EIS. Issues and concerns dealing with individual projects and techniques to be used will guide site-specific environmental analyses, and be conducted in accordance with NEPA.

Economic Considerations

Economic losses resulting from gypsy moth infestations in the Northeast have been dramatic. USDA Forest Service and APHIS reported to Congress that losses to homeowners, forest product industries, and recreation areas were $272 million in 1980 (USDA 1981b). Timber losses alone in 1981 were estimated at $72 million (USDA 1982). In New Jersey and Pennsylvania, timber loss has been particularly severe in the last decade.

In one study on Stokes State Forest in northwestern New Jersey, the 1979 and 1980 gypsy moth infestations killed more than 15.5 million board feet and 145,000 cords of timber. This in effect reduced the oak growing stock on the forest by 50 percent. Economic losses on this forest alone were estimated to be more than $3 million in a State where the estimated stumpage value of forest products harvested annually is $8.6 million (NJ DEP 1982).

In another study, the Pennsylvania Department of Environmental Resources estimated timber losses in State woodlands resulting from gypsy moth infestations during the 1970's. Based on surveys of 2.2 million acres, it was estimated that more than 545 million board feet of sawtimber and 462 million cubic feet of pulpwood were lost. This represents an average stand loss of 20 percent, valued at more than $36 million (PA DER 1980).

Significant gypsy moth economic impacts are predicted outside of the generally infested area if isolated infestations are not eradicated. In a study prepared for the California Department of Food and Agriculture, Galt (1983) estimates that urban, agriculture, and forestry losses could range between $446 million and $457 million between 1982 and 1999 if isolated gypsy moth infestations are allowed to spread.

USDA PARTICIPATION

Statutory Authority

Laws applicable to the USDA Forest Service and APHIS that govern participation in suppression and eradication projects are:

(1) The Cooperative Forestry Assistance Act of 1978 (P. L. 95-313), which incorporated provisions of the Forest Pest Control Act of 1947 (now repealed), provides authority for Federal/ State cooperation in forest insect and disease management. The law recognizes that the Nation's capacity to produce renewable forest resources is significantly dependent on non-Federal forest lands. Therefore, the Secretary of Agriculture is authorized to assist in the control of forest insects and diseases on non-Federal forest lands of all ownerships to (a) enhance the growth and maintenance of trees and forests and (b) promote the stability of forest-related industries, and employment associated therewith, through protection of forest resources.

(2) The Plant Quarantine Act of 1912 as amended (7 USC 151-165, and 167); the Federal Plant Protection Act of 1957 (7 USC 150aa-150jj); and the cooperation with States in Administration and Enforcement of Certain Federal Laws approved September 2, 1963 (7 USC 450). These statutes authorize among other things the development of APHIS activities for the regulation of the artificial spread of the gypsy moth from the quarantined area, and the eradication of isolated gypsy moth infestations outside this area.

(3) The National Environmental Policy Act of 1969 (P. L. 91-190 42 USC 4321 et seq) requires detailed environmental analysis of proposed major Federal actions that may affect the quality of the human environment. Generally, the courts have regarded those State actions which involve potential environmental consequences, and for which purpose Federal funds are granted, as Federal actions (Atherton 1977).

(4) The Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (7 USC 136) as amended requires that insecticides used in suppression and eradication projects be registered by the EPA.

Agency Goals

The following USDA goals are considered in the evaluation of gypsy moth suppression and eradication projects:

(1) A principal USDA goal is to assure an adequate supply of high-quality food and fiber and a quality environment for the American people. The USDA gives special emphasis to the development and use of efficient and environmentally acceptable integrated pest management systems. All methods, including the use of chemical pesticides, are considered in integrated pest management projects.

(2) Forest Service policy is to protect and preserve the forest resources of the Nation against destructive forest insects and diseases. Pest outbreaks will be prevented or suppressed by methods that will restore, maintain, and enhance the quality of the environment. These objectives are attained on non-Federal lands through cooperation with State foresters or equivalent State officials. Pests are suppressed directly on National Forest System lands and in cooperation with responsible officials on other Federal lands. Projects approved for cooperative financing must meet Forest Service standards for environmental, biological, and economic acceptability and must meet Forest Service Federal role criteria (FSM 3430). Approval is based on the results of an environmental analysis conducted in accordance with NEPA regulations.

(3) The goal of the APHIS/State cooperative regulatory program is twofold: to retard or prevent the artificial, long-distance spread of the gypsy moth and to eradicate isolated infestations when detected. This is accomplished by enforcement of regulations on the movement of articles that contribute to this artificial spread. The major articles regulated are nursery plants, logs and pulpwood, outdoor household articles, firewood, and mobile homes and recreational vehicles. APHIS also is charged with detection and eradication of infestations subsequently established as a result of the artificial movement of gypsy moth life stages into unregulated areas. Only APHIS eradication projects are fully addressed in this document. Cooperation with State agencies in eradication projects is based on the availability of Federal funds, a mutually agreed upon plan of work, and the results of

site-specific environmental analyses conducted in accordance with NEPA. Gypsy moth surveys provide information about pest distribution that serve to guide both regulatory and eradication activities.

As a general rule, Federal participation in eradication projects will only occur when gypsy moth populations are identified that are: 1) geographically removed from areas known to be generally infested, 2) the result of artificial spread as opposed to natural spread, and 3) well defined by delimiting traps. An exception to item 3 would be where reproducing populations are found as evidenced by egg masses without adequate delimiting trapping. Precautionary treatments may be prudent prior to delimit trappling in such situations.

The present USDA Forest Service suppression goals should not be confused with eradication policies of earlier years (pre 1960's) in the Northeast. No attempt is being made to treat all of the areas infested. In fact, Federal/State suppression projects usually treat less than 10 percent of the areas infested in any given year. Parasites, predators, and natural mortality factors are being relied on to exert biological pressures on the majority of gypsy moth infestations. Treatment of localized high-value and high-use areas in suppression projects is intended to meet short-term objectives identified by cooperating State and Federal agencies. Regulatory activities (quarantines, inspections, and treatments) by APHIS lower the risk of artificial spread of the gypsy moth.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

ALTERNATIVES CONSIDERED

The alternatives presented in this FEIS meet the State and Federal suppression and eradication objectives, address issues and concerns raised through scoping activities, and adhere to USDA guidelines governing Forest Service and APHIS participation in suppression and eradication projects.

The four alternatives considered and evaluated are:

(1) No action.

(2) Chemical insecticide treatment.

(3) Biological insecticide treatment.

(4) Integrated Pest Management (IPM) (selected).

Three additional alternatives were considered but eliminated from detailed study because all are still undergoing field testing and development, and as individual alternatives, none has demonstrated the effectiveness necessary for meeting gypsy moth suppression and eradication objectives. These alternatives are:

(1) Parasite and predator management.

(2) Release of sterile or partially sterile gypsy moth life stages.

(3) Intensive forest stand manipulation (silvicultural control).

Although not fully developed, these alternatives are presented and discussed as possible components of the IPM alternative (#4).

COMPARISON OF ALTERNATIVES

No Action

The no action alternative in this document means that no USDA-funded suppression or eradication projects will be conducted on State, private, or Federal lands. However, technical assistance would still be available. Isolated infestations would be subject to regulatory action imposed by APHIS or State regulatory agencies in the form of

quarantines, inspections, and some type of treatment of infested materials shipped from the quarantine areas.

Selection of this alternative, however, would not preclude some type of action taken by State, municipal, or private individuals to suppress or eradicate gypsy moth populations.

Therefore, some suppression of outbreak populations may occur within the infested northeastern States. In addition, communities or towns may elect to finance their own suppression as may individual land owners. However, many areas that may need suppression would receive none.

Most opportunities for coordination of suppression between States and within State municipalities and townships would be lost. Depending on the overall organization of suppression efforts, communities and individual landowners may have reduced opportunities for participation in the decisionmaking process. Increased losses of timber and shade trees would be expected to occur.

Isolated infestations that remain untreated would be expected to expand through natural spread of the insect. Depending on the local environmental and physical conditions, the expansion may be rather slow or quite rapid. After untreated populations build to defoliating levels, there will be losses of shrubs, ornamental trees, and timber, and increased insect nuisance.

As impacts on timber and ornamental shade trees increase in the infested areas, and as the isolated infestations increase in number and size, the USDA Forest Service and APHIS will have difficulty in meeting statutory authorities contained in the Cooperative Forestry Assistance Act of 1978 and the Plant Quarantine Act of 1912, as amended.

Chemical Insecticide Treatment

The chemical insecticide treatment alternative would result in funding of proposals using chemical insecticides such as carbaryl, trichlorfon, diflubenzuron, and acephate. These insecticides have successfully achieved the desired objectives in previous suppression and eradication projects, and are registered by the EPA for application against the gypsy moth.

The chemical insecticides will meet project objectives. Because the mode of action of most of these insecticides is by contact, they take effect in a matter of hours after application, and subsequently provide a minimum of 70 percent host foliage protection, and a 90-percent reduction in the number of larvae present and residual egg masses. Further, they can be applied over a wide timeframe during the gypsy moth larval phase and still be effective in reducing gypsy moth populations, though adequate foliage protection may not be achieved.

Implementation of this alternative will provide immediate relief from the presence of gypsy moth larvae in communities and recreation areas. Potential allergic reactions associated with larval droppings and the hairs on gypsy moth larvae will be reduced. Hazardous roadways and sidewalks caused by slipperiness from stepping on or driving over gypsy moth larvae will be minimized.

The comparative effects of registered insecticides commonly used in USDA gypsy moth suppression and eradication projects are presented in Table 2. The chemical insecticides as a group are broad-spectrum insecticides that will affect some nontarget insects in the treatment areas, including gypsy moth parasites and pollinators (especially bees). The degree to which these nontarget insects are adversely affected depends on the insecticide and particular formulation used, and mitigating measures implemented.

The Division of Agricultural Sciences, University of California, categorized the relative toxicity of pesticides to honeybees based on laboratory and field tests (Atkins et al. 1981). Using their categories, the chemical insecticides used in gypsy moth suppression and eradication projects ranged from highly toxic to relatively nontoxic.

For example, the insecticide formulations Sevin 80S®(carbaryl) and Orthene® (acephate) are rated as highly toxic to honeybees, with severe losses expected if used when bees are present at treatment time or within a day thereafter. The formulation Sevin 4 Oil® (carbaryl) is rated as being moderately toxic, and can be used around bees if dosage, timing, and method of application are correct, but should not be applied directly on foraging bees or to the hives. The insecticides Dimilin® and Dylox® are rated as relatively

Table 2. Comparative effects of registered insecticides used in USDA gypsy moth suppression and eradication projects.*

Characteristic	Pesticide						
	Diflubenzuron	Trichlorfon	Carbaryl	Acephate	Bacillus thuringiensis	Nucleopoly-hedrosis virus	Disparlure
I. Biological Efficiency							
1. Contact poison	0	X	X	X	0	0	0
2. Stomach poison	X	X	X	X	X	X	0
3. Rapid larval knockdown and mortality	0	X	X	X	0	0	0
4. Foliage protectant 1/	X	X	X	X	X	X	0
5. Ovicidal activity	X	0	0	0	0	X	0
6. Population control	X	X	X	X	X	X	X
7. Pre-budbreak control	X	0	0	0	0	0	0
8. Mating disruption	0	0	0	0	0	0	X
II. Economic Feasibility							
1. Tolerance established on agricultural crops	X	X	X	X	0	0	0
2. Dosage lb a.i./acre	.03-.06	1.0	1.0	0.5	8-16 2/	25-125 3/	1.8 4/
3. Number of applications 5/	1/yr.	1	1	1	1+	2	1
4. Insecticide cost per acre (1983) 6/	Low	Medium	Medium	Medium	Medium	High	Medium
III. Environmental Effects							
1. Residual activity on foliage (10 days)	X	0	X	0	0	0	X
2. Half-life:							
--water (1-2 days)	X	X	X	0	X	X	0
--soil (.5-1 week)	X	X	0	X	X	X	0
3. Adverse effects on nontarget insects:							
--parasites & predators	0	X 7/	X	X	0	0	0
--pollinators	0	0	X	X	0	0	0
4. Adverse effects on wildlife as a group	0	0	0	0	0	0	0
5. Adverse effects on aquatic organisms:							
--invertebrates	X	0	X	X	0	0	0
--fish	0	0	0	0	0	0	0
6. Causes temporary territory abandonment by birds	0	X	X	X	0	0	0

1/ Foliage protection would be achieved by definition when tree refoliation was prevented.
2/ Bacillus thuringiensis may be applied at 8-16 Billion International Units per acre per application.
3/ Nucleopolyhedrosis virus is applied at 25-125 million gypsy moth potency units per acre application depending upon natural virus levels in the target area (not currently available for operational use).
4/ Hercon Luretape applied at forty 2-square inch tapes/acre is equivalent to 1.8 grams disparlure/acre.
5/ Eradication treatments involve at least 2 applications.
6/ Low - $9/acre, medium - $9-15/acre, high - $15/acre/application including application and administrative costs.
7/ May temporarily reduce Tachinid fly population.

* NOTE: X = observed effect

0 = no observed effect

nontoxic and can be used around bees with minimal injury.

In December of 1982, the EPA reviewed a number of studies submitted by Union Carbide in support of revised honeybee labeling for Sevin XLR. Based on work by Atkins et al, EPA concluded that Sevin XLR is highly toxic to honeybees exposed to direct application.

Similarly, the persistence of the chemical insecticides in the physical environment also varies according to the individual insecticide and formulation used. However, as described in Table 2, these insecticides as a group are short lived except for diflubenzuron and carbaryl, which have residual activity on foliage of at least 10 days.

Implementation of this alternative will not alleviate the concerns of individuals questioning the use of the chemical insecticides. However, the use of a public involvement and notification program can help minimize these concerns so that individuals residing in treatment areas are aware of the proposed treatment and the available scientific data regarding possible adverse human health effects.

The cost of chemical insecticides for gypsy moth suppression and eradication projects ranges from \$3 to \$7 per acre per application for material. Total costs, including material, pesticide mixing, loading and application, may range from \$10 to \$15 per acre per application depending on the chemical used, the number and size of treatment areas, and contract requirements. Cost of ground applications range up to \$50 per acre or more depending on these same factors.

Biological Insecticide Treatment

The biological insecticide treatment alternative would result in funding of proposals using biological insecticides. The biological insecticides considered and evaluated during the environmental analysis were formulations of *Bacillus thuringiensis* (*B. t.*) and the gypsy moth *nucleopolyhedrosis virus* (NPV). Both are registered by the EPA for application against the gypsy moth. The gypsy moth NPV, however, is currently undergoing field tests and is not ready for operational use at this time. The comparative effects of insecticides commonly used in USDA suppression and eradication projects is presented in Table 2.

The biological insecticides are considered as environmentally safe and are not known to present any risk to human health. Neither B. t. nor gypsy moth NPV has been shown to adversely affect fish, birds, mammals or most nontarget insects. However, B. t. will affect other lepidopterous larvae if they are present in project areas. The registered NPV product has a shorter residual life in the environment than naturally occurring NPV in gypsy moth populations. The biological insecticide treatment alternative best minimizes adverse impact on soil, air, water, and humans.

The effectiveness of biological insecticides is dependent on proper application timing. The efficacy of a biological insecticide is also more dependent upon weather conditions, especially rain, than chemical insecticides. Unlike chemical insecticides, biological insecticides must be ingested by gypsy moth larvae to be effective. Younger larvae (1st to 3rd instar) are much more susceptible to the biological insecticides than are older larvae (4th instar and beyond). As a result, there is only about a 2-week optimal treatment "window" during which application of biological insecticides can be expected to achieve maximum effectiveness. Gypsy moth population reduction and host-free foliage protection can be achieved, but to a lesser extent, if the optimal treatment "window" is missed. Since biological insecticides must be ingested, it generally takes 7 to 10 days before larvae die. During this time some insects may continue to feed to some degree and defoliate the host trees. Should application timing be too far past the optimal "window," management objectives may not be achieved. As a result, the biological insecticide treatment alternative may not provide maximum abatement of insect nuisance in some cases; however, it would alleviate some public concerns associated with the use of chemical insecticides.

Recent advances in the use of B. t. have demonstrated that under many treatment conditions, a single application of 12 Billion International Units (BIU) per acre is as efficacious as 2 applications at 8 BIU per acre, each. This makes B. t. more economical to use than in the past. Current costs for B. t range from $3 to $5 per acre for material. Total costs including material, mixing, loading, and application generally are under $10 per acre, depending on project size. Where more than one application of B. t. is required, total cost rises

proportionally. Costs of ground application are comparable to those for the chemical insecticides.

It is estimated by USDA that gypsy moth NPV, though not operationally available at this time, would cost about the same to use as *B. t.* However, because NPV currently requires two separate applications, 7 to 10 days apart, total project costs are estimated to be twice that for *B. t.* except where more than 1 application of the latter is required.

The recent demonstrated efficacy of a single application of *B. t.* in suppression projects and the reduction in product costs, make *B. t.* economically efficient to use in some areas. This has positive implications for suppression project benefit-cost analyses.

The biological insecticide alternative would be justified where special environmental concerns have been identified, and where absolute protection of host foliage and a reduction in gypsy moth populations are not required.

Integrated Pest Management (Selected)

The IPM alternative would result in funding of proposals to cooperating State and Federal agencies to support use of an IPM strategy for gypsy moth suppression and eradication projects. The components of this strategy include quarantines, inspections, biological and/or chemical insecticide application, parasite and predator management, application of the gypsy moth pheromone, release of sterile or partially sterile gypsy moth life stages, and forest stand manipulation.

At this time, parasite and predator management, release of sterile or partially sterile gypsy moth life stages, and forest stand manipulation are undergoing field testing and are not available for operational use.

The IPM alternative would affect the environment only to the extent that the various components are used. The impact on soil, air, and water would depend on the amount of acreage treated with chemical or biological insecticides. Impacts on soil, air and water can be further reduced by careful monitoring of gypsy moth larval populations and treating a minimum number of acres with insecticides to achieve specific goals. Areas where parasites or other natural controls

are exerting adequate biological pressure on gypsy moth populations probably would not receive insecticide treatment.

An IPM approach which includes the use of both chemical and biological insecticides and other available components can be expected to achieve the objectives of gypsy moth suppression and eradication projects. In terms of foliage protection and population reduction, IPM will perform somewhat less effectively than the chemical insecticide alternative and somewhat better than the biological insecticide alternative.

The cost of implementing the IPM alternative depends upon the extent to which the various operational components are used. The cost of using biological or chemical insecticides was discussed previously. The cost of using disparlure as a mating disruptant strategy is estimated at about $20 per acre for the disparlure-treated tape applied at 20 g active ingredient per acre. Application of the tape in the grid pattern would require at least $1 to $2 per acre, unless the application was handled as a community project. The cost of aerial application of disparlure-impregnated flakes (20 g active ingredient per acre) is estimated at $20 per acre. 2/ Determination of benefit-cost ratios for disparlure application will require additional field evaluation.

Economic information on the use of sterile or partially sterile gypsy moth life stages suggests that at the cost of current avenues being developed it could be competitive with the use of conventional pesticides. However, it is important to point out that this approach will be economically feasible only in extremely low-level populations. The cost of implementing other IPM components is not known at this time.

MITIGATING MEASURES

Procedures, guidelines, and other measures can be implemented to mitigate nontarget effects in suppression and eradication projects that include

---

2/ Letter from A. R. Quisumbing, Health-Chem Corporation to Noel F. Schneeberger, NA, S&PF, USDA FS, dated November 2, 1983.

the use of insecticides. During application, insecticide droplets can settle in nontarget areas. Potential impact in those areas as well as exposure to nontarget organisms, including humans, can be minimized by using the proper type of application equipment, proper calibration of this equipment, adherence to strict standards for site and insecticide selection, and by following the operational plan for the project, including the use of buffer strips where necessary.

State and Federal agency participation in USDA suppression and eradication projects provides for early public involvement in the selection of treatment areas and where appropriate, the identification of exclusion areas, and mitigating measures to be used. Through public involvement and notification, individuals known to be allergic to certain insecticides can be notified and appropriate measures can then be taken to avoid exposure to that insecticide. In order that the public is aware when insecticides will be applied, persons living within all treatment areas will be notified by telephone, local newspaper, local radio, individual letter, and/or personal contact as to treatment dates. Users of public recreation areas will be notified in parks or campgrounds. Potential exposure to insecticides is greatest for individuals involved in the actual mixing and application. Proper protective clothing and safety procedures will minimize any risk to individuals involved in these tasks. Safety plans will provide for contingencies, such as pesticide spills and worker exposure.

Specific mitigating measures for suppression and eradication projects will be developed and subsequently implemented on a case by case basis as identified through site-specific environmental analyses, and documented in accordance with NEPA.

A general discussion of treatment area and insecticide selection considerations, application procedures, and monitoring follow. Specific methods and procedures will be identified during site-specific environmental analyses for proposed suppression and eradication projects as necessary.

Treatment Area Selection

In general, public involvement at the community, township, county, and/or State level is an integral part of the treatment-area selection

process. Local news media and public meetings are used to inform the public that financial and technical assistance for suppression and eradication projects are available.

Responding to requests from the local level, the State conducts field evaluations to determine if the proposed suppression projects meet the necessary criteria for treatment. Field evaluations of proposed treatment areas include assessment of egg mass size, numbers, and viability; previous defoliation; and land use category. Local residents decide whether or not to participate in a cooperative gypsy moth suppression project for those potential treatment areas that meet specific State criteria.

Treatment-area selection in APHIS eradication projects, for Federal and State and private lands, is tied very closely to biological evidence of where gypsy moths are present and reproducing. Highly effective adult male pheromone traps supplemented by larval traps and visual surveys for egg masses provide this biological information. These data, along with the potential for buildup and spread from such areas and environmental impact, are considered before proposing areas for eradication treatment. Individuals do not have a choice of electing to opt out of an eradication project. Cooperating agencies are advised to use the local news media and public meetings to involve the public in the development of these projects.

Minimum treatment area selection criteria are the same for suppression projects on Federal and State and private lands.

Insecticide Selection and Application Procedures

Where insecticides are proposed for use, specific selection for that project will be addressed in site-specific environmental analyses documented in accordance with NEPA.

The insecticide selection process considers the project objectives, environmental sensitivities of proposed treatment areas, and the biological and economic efficiency of each insecticide. In addition:

(1) the insecticide must be registered with the EPA for use on the proposed site.

(2) the method of application must conform with label specifications.

The ultimate fate of insecticides released in the atmosphere depends on the insecticide and its formulation, the type of equipment used to apply the material, and the atmospheric conditions during the time of application. The operational plan developed for specific gypsy moth suppression and eradication projects will contain measures designed to maximize insecticide deposition on the target area. Insecticides will be applied in accordance with applicable laws and regulations.

Most gypsy moth suppression and eradication projects will be undertaken using single- or multiple-engine fixed-wing aircraft, or helicopters. Only aircraft that are highly maneuverable and can operate at slow airspeeds close to the tree canopy are used. Precise control of insecticide application is necessary. Pilots can more easily identify hazards and treatment boundaries, and make the necessary insecticide shutoffs. Low-elevation application directly over treatment areas minimizes insecticide drift out of and within the target areas. In addition, observer planes can be used on projects to direct the aerial applicators to the treatment areas, to notify pilots of exclusion areas (no treatment), and to monitor delivery of the insecticide--its release from the aircraft, deposition, and drift. In this way, any mechanical problems can be identified quickly and adjustments can be made in the applications, or the project can be shut down if the insecticide is not falling in the target areas. In areas where Federal Aviation Agency regulations prohibit low-level flying, waivers can be sought to make low-level applications.

Individual treatment areas may range from several acres to several thousand acres depending on the type of project and its location (residential areas vs. forested areas). Treatment areas may include recreational sites, selected high-value forest stands, residential areas including suburban and rural residential areas with sufficient gypsy moth host-type where the insect may create a local impact, including isolated infestations. Consequently, there should be few, if any, treatment exclusion areas within most treatment areas. Treatment and exclusion areas, where appropriate, are identified on large-scale maps that will be used to orient the aerial applicators. If necessary, treatment areas can be designated with helium-filled weather balloons or some other technique that will be highly visible

from the air. Treatment exclusion areas will be observed by aerial applicators during pretreatment overflights of all areas.

Insecticides will be applied only when weather conditions favor effective insecticide penetration and dispersal into the target areas. Aerial suppression and eradication projects adhere to the following general guidelines:

(1) To minimize drift, application of insecticide will be made when the wind speed does not exceed 10 mph.

(2) Generally, insecticide application should not be attempted when temperatures exceed 80°F. High temperatures can cause excessive evaporation of the insecticide suspension before it reaches the target. The amount of evaporation depends on the type of insecticide being used. Inversion layers may form in the air when temperatures rise and prevent insecticide deposition.

(3) Insecticide application will be suspended when rain is imminent. Insecticides will be applied only when the target foliage has dried sufficiently.

(4) The treatment will be suspended whenever the insecticide does not appear to be settling in the target area.

Most insecticide treatments are applied in the early morning (4:30 am to 10:00 am) and late afternoon-early evening hours (4:00 pm to 9:00 pm), as this is when atmospheric conditions generally are the most favorable for maximizing insecticide deposition in treatment areas. Occasionally insecticide applications may continue throughout the day, so long as conditions are favorable.

Where aerial application of insecticides is not appropriate, ground equipment may be used. Specific ground application guidelines will be developed on a site by site basis in order to mitigate unacceptable environmental impacts. These specific guidelines will be identified during site-specific environmental analyses for suppression and eradication projects and conducted in accordance with NEPA.

Beekeepers in and adjacent to treatment blocks will be notified as to the time of treatment, insecticide to be used, and the availability of pollen traps if applicable. All residents or persons visiting a treatment area are notified in advance of treatment so that they may leave or stay indoors at the time of treatment depending on their personal health and desires.

Monitoring Procedures

Monitoring is a continual process taking place before, during, and after treatment application. Specific monitoring techniques used to determine gypsy moth population levels and subsequent candidate treatment areas, to evaluate proper insecticide deposition and to evaluate project efficacy are identified in the cooperating State or Federal agency proposals. In suppression projects, State and Federal cooperators usually begin the process by conducting egg mass surveys to determine treatment areas. The egg masses in selected areas may be monitored for winter survival and the effects of parasites and predators to determine if treatment still is needed. In planning eradication projects, sampling of other gypsy moth life stages is necessary to determine whether a potential low level, reproducing population exists.

During insecticide application, spray deposit cards or a similar technique can be used to check deposition and drift. Observer aircraft may be used during aerial insecticide applications to monitor spray dispersal. Daily weather measurements of temperature, wind speed, and relative humidity generally are made on site, and subsequent communication with weather stations to help ensure that insecticide application is made under the proper weather conditions.

Following suppression activities, project personnel generally visit a representative sample of treatment blocks to assess larval mortality. Later in the summer, aerial defoliation estimates will be conducted statewide. Ground estimates may be made if necessary. In the fall, egg mass counts are conducted in selected areas to measure population reduction. Because of extremely low populations found in eradication projects, treatment efficacy is monitored by larval traps and/or male moth pheromone traps.

AFFECTED ENVIRONMENT

HOST VEGETATION

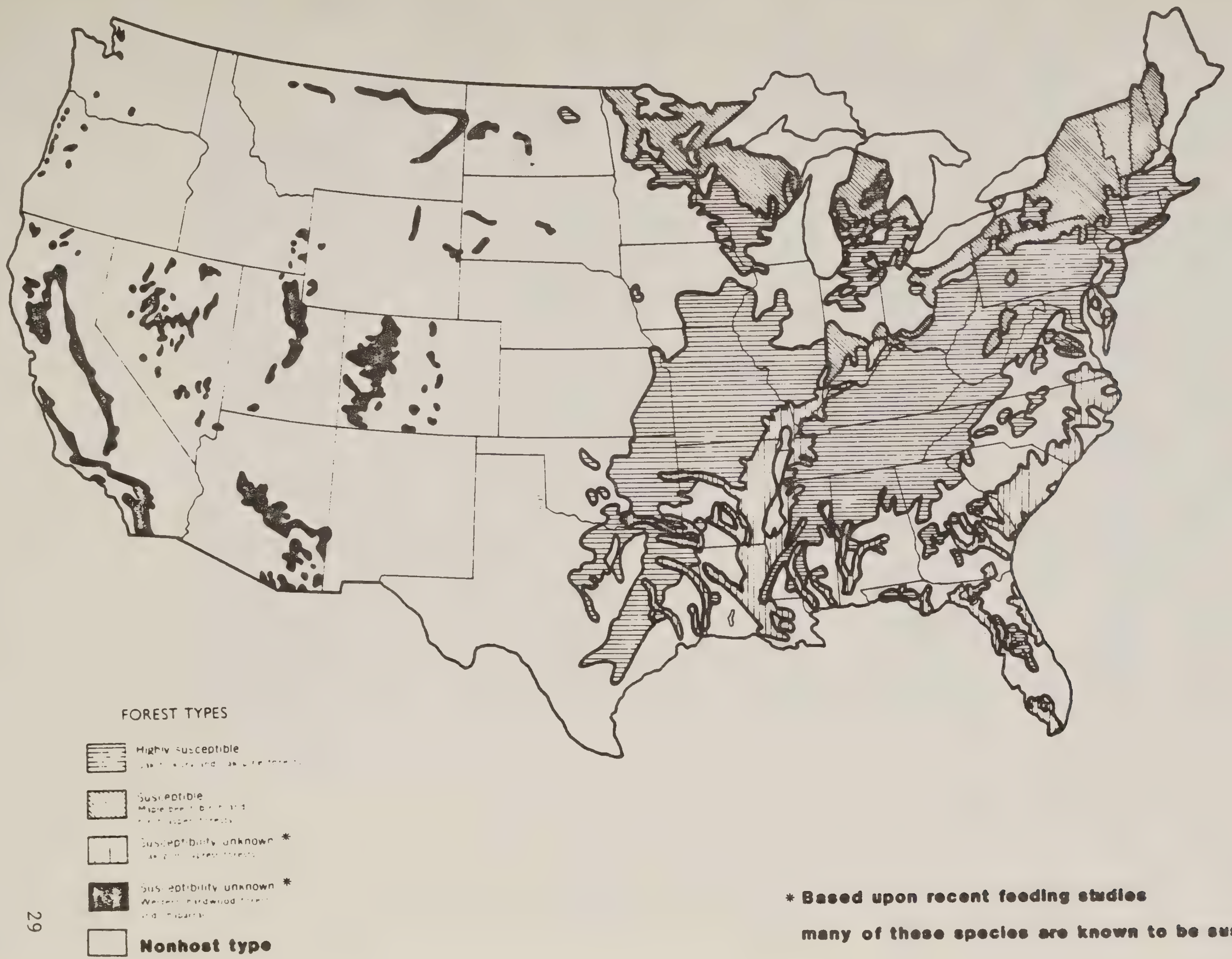
The gypsy moth feeds on more than 300 species of trees and shrubs (USDA 1981a). Figure 1 depicts the location of forest host types in the continental United States that are susceptible to gypsy moth infestation. Preferred hosts are oak species, especially white oak. Additional hosts include apple, basswood, gray and river birch, sweetgum, hawthorn, poplar, beech, willow, and other oaks. Less desired but still attacked are black birch, yellow birch, paper birch, cherry, hemlock, cottonwood, elm, sassafras, spruce, and pine. Older gypsy moth larvae feed on the foliage of several species that younger larvae normally avoid, particularly hemlock, pine, and spruce. The gypsy moth avoids ash, balsam fir, butternut, black walnut, catalpa, red cedar, flowering dogwood, American holly, locust, sycamore, tulip (yellow) poplar, and shrubs such as native laurel, rhododendron, and arborvitae. However, in outbreak situations, gypsy moth larvae will feed on almost all vegetation.

Recent gypsy moth feeding studies with late 3rd-instar larvae were conducted on plant species common to California (Edwards and Fusco 1981). Study results indicate that the following host types appear to be susceptible to gypsy moth: grand fir; acacia; red elder; apricots; manzanita; beefwood; California hazel; escallonia; eucalyptus; hakea; sweetgum; ironwood; photinia; white spruce; Norway spruce; Coulter pine; Jeffrey pine; Monterey pine; Digger pine; *Pinus halpensis*; *Pinus thunbergiana*; Douglas-fir; pyracantha; blue oak; California black oak; California white oak; cork oak; hawthorn; lemonade berry; weeping willow; redwood; western redcedar; and western hemlock. As gypsy moth populations continue to spread to the South and West, the number of plant species known to be susceptible will undoubtedly increase.

POTENTIAL TREATMENT SITES

Permanent residences often occur throughout the range of susceptible vegetation host. On private land, permanent and seasonal houses are located in suburban/urban areas, rural residential areas, and in forested areas. Entire developments and

Figure 1. Forest types susceptible to gypsy moth.



* Based upon recent feeding studies many of these species are known to be susceptible.

forested communities are designed and constructed to maintain a forest setting. On public lands, forested areas are developed into recreational areas, campgrounds, picnic areas, hiking trails, and scenic areas. Visitors include campers, canoeists, anglers, hikers, and others. Most of the recreational use is concentrated around water, scenic areas, or parks.

Gypsy moth suppression projects may be conducted in urban, suburban, or rural communities as well as in unpopulated forests. In suppression projects, individuals have the option of not participating in the proposed project to the extent allowed by State law.

APHIS eradication projects may require treatment of infestations that range from highly populated urbanized areas to rural or uninhabited sites. In addition, infested sites may range from generally open areas occupied with shrubs and those with occasional ornamental trees to highly forested communities or uninhabited forests. In all of these sites, the public involvement process will allow individuals an opportunity to provide input into the decisionmaking process. However, since the goal of the project is eradication, individuals do not have the option of having their property excluded from treatment.

NONTARGET ORGANISMS

There are many species of fish, mammals, reptiles, birds, and amphibians that inhabit the various forest types susceptible to gypsy moth infestations. Other nontarget organisms occurring in gypsy moth-susceptible host types include terrestrial and aquatic insects; pollinators, including bees needed for honey production; gypsy moth parasites and predators; and soil organisms. Some insect populations may be reduced temporarily by insecticides used for gypsy moth suppression.

Gypsy moth suppression and eradication projects are not expected to adversely affect threatened and endangered species that may be found within treatment areas. However, pursuant to the Endangered Species Act of 1973, consultation procedures will be initiated with the USDI Fish and Wildlife Service to identify any projects that may affect threatened and endangered species. Since suppression and eradication activities may

take place anywhere in the United States where there are susceptible hosts, evaluations of threatened and endangered species will be addressed in site-specific environmental analyses, and conducted in accordance with NEPA.

GEOGRAPHY

Gypsy moth will continue its natural spread south and westward into States not now generally infested.

The insect is now permanently established in all or parts of the following States: Connecticut, Delaware, Maine, Maryland, Massachusetts, Michigan. New Hampshire, New Jersey, New York, Rhode Island, Pennsylvania, Vermont, Virginia, and West Virginia.

Because the geography and other related physical factors of these areas vary considerably, they will be addressed during site-specific environmental analyses, and conducted in accordance with NEPA for the particular areas proposed for treatment.

APHIS eradication projects will be conducted in areas where the insect has been introduced artificially. These artificial introductions may occur in areas throughout the continental United States and Hawaii. Treatment areas may occur in any geographic or physical setting, from low coastal to mountainous areas. Because these factors may vary considerably, they will be identified during site-specific environmental analyses conducted in accordance with NEPA for the particular areas being considered for eradication treatment.

ENVIRONMENTAL CONSEQUENCES

NO ACTION

This alternative would not necessarily eliminate gypsy moth suppression or eradication activities. State agencies, local communities, and individuals may undertake projects without Federal financial assistance. Under this alternative, the following general effects can be expected.

In the infested areas of the Northeast, if no action is taken by either State or local agencies or by individuals, gypsy moth-caused tree defoliation and subsequent mortality will occur.

Gypsy moth populations will increase and then collapse--a cycle of several years. Impacts of unimpeded gypsy moth-caused tree defoliation include tree mortality, reduced growth, and changes in forest stand composition. These effects will be dramatic in the short term and their effects will last for many years. Several case studies illustrate the point. A study by Kegg (1972a) found that 2 years of heavy defoliation in northern New Jersey in 1969 and 1970 killed 63 percent of the oaks in the study area. Stephens and Hill (1971), studying changes in Connecticut forests from 1959 to 1970, found that repeated defoliation increased oak mortality by 50 percent.

A reduction in radial growth also is associated with defoliation by forest insects (Kulman 1971). In Europe, reductions of 15 to 67 percent were observed following severe gypsy moth outbreaks (Mirkovic and Miscevic 1960; Kondakov 1963). Similar observations have been made in the United States (House 1960; Minott and Guild 1925).

It is generally believed that gypsy moth activity tends to influence forest stand composition (Campbell and Valentine 1972; Stephens 1971). This might be perceived as being beneficial in some areas by reducing favored food hosts. However, Bess et al. (1947) stated that "frequent severe defoliation will generally create conditions highly favorable to future epidemics."

Several years of heavy gypsy moth defoliation may have an adverse impact on existing wildlife (Campbell 1979). It is logical to assume that animals that normally inhabit forests will be adversely affected by several years of gypsy moth-caused defoliation and subsequent tree mortality.

In the infested areas of the Northeast, where there is a complex of parasites and predators, it is possible that these organisms, as well as other natural controls such as wilt disease, will eventually reduce gypsy moth populations. However, this will not occur immediately, and dramatic effects such as those discussed earlier will occur.

Streams shaded by forest trees are inhabited by aquatic plants and animals. Defoliation removes the shade from those streams, producing light and heat greater than the average to which the aquatic life is adapted. In the year of defoliation, these conditions last until the trees refoliate. Under several years of successive defoliation, such conditions, while only temporary the first year, may become more permanent characteristics if tree mortality changes the composition of tree species.

Heavy gypsy moth populations may affect water quality and quantity. Frass excreted by larvae is considered both a nutrient dump and water pollutant. Observations on the impact of frass are scarce. Turner (1963) stated: "Heavy defoliation produces hundreds of pounds of frass which soon is washed into the water by rain. The effect on the quality of water is immediate in small reservoirs. Moreover, the nutrient elements in the frass increase the growth of algae in water, creating an additional problem of longer duration." A similar observation was reported for New Jersey reservoirs (Kegg 1972b).

Where gypsy moth-caused defoliation and subsequent tree mortality is severe, there is less vegetation to intercept rainfall and to impede the movement of ground water. This could increase streamflow but at an added cost. Water quality might be lowered due to increased runoff of soil and soil nutrients previously held in place by vegetation now destroyed by gypsy moth. Defoliation along

streams may result in increased water temperatures that not only affect existing aquatic organisms but also influence plant compositions along stream banks. While the impact of gypsy moth on soil and plants other than trees has not been studied in detail, it is known that when the forest floor is opened to unaccustomed heat and light, changes in forest soil and plant life occur (Bess et al. 1947; Kegg 1972b).

Gypsy moths invading homes can seriously affect individuals with a fear of insects. Some individuals actually have cut down all trees on their property to avoid the nuisance of the insect. Others have advoided the use of summer homes during the period in which larvae are feeding.

Recent medical studies have confirmed that the hairs on gypsy moth larvae can cause skin rashes and welts (Shama et al. 1982; Beaucher and Farnham 1982). The intensity of allergic reactions in some individuals surprised researchers. Some individuals could not sleep at night and required injection of corticasteroids for relief after simple antihistamine and topical treatments failed (Beaucher and Farnham 1982).

Conditions experienced in Pennsylvania during the 1973 outbreak are reported in this summary (PA DER 1973):

> Carbon and Schuylkill Counties were considered by local officials to be disaster areas. The mayor of Tamaqua declared a state of emergency as caterpillars invaded the town and the water supply reservoir. Farmers in outlying areas reported corn and alfalfa being eaten. A new form of "control" was witnessed near Tamaqua as a homeowner started a fire under trees in his yard. The flame and heat did a good job on the trees as well as the gypsy moth. Signs of all descriptions appeared along Schuylkill County roadsides denouncing government officials from the local level to Washington. In some areas, housewives reported that caterpillars had invaded homes and began eating house plants. Golfers reported that putting greens were

literally moving with migrating caterpillars. People on vacations checked into untreated resorts but left the next day.

Even the natural disease agents affecting gypsy moth may be unpleasant. The disease-killed larvae hang from their sheltered places on houses; their bodies rupture and the rotted fluid contents spill out, staining homes. Bacteria grow in the fluid, making the stench of a diseased population detectable from a distance.

It is difficult enough for people to live with the larvae and frass of a gypsy moth outbreak. Yet they also must endure the experience of having the trees around them stripped of their leaves in June and July. Hardwood trees losing about two-thirds of their foliage generally develop another set of leaves (refoliate), beginning about mid-July. Such leaves usually are smaller, off-color, and fewer in number than the original leaves. In addition, refoliation decreases valuable sugar reserves needed to sustain the tree through the following spring and winter.

Two important impacts resulting from defoliation are reduced benefits and enjoyment from the trees. These two impacts blend but it is convenient for this discussion to treat them as separate entities.

The direct benefits derived from trees that are in full foliage include cooling and humidifying effects, shade, reduced sound levels, privacy, and shelter from wind. These benefits often are taken for granted, and it is when the leaves are gone that many people realize clearly the benefits that trees provide.

Gypsy moth-caused defoliation drastically alters the forest homeowner's environment. One purpose for living among trees is to enjoy them; robbed of that enjoyment by the gypsy moth, a person may experience decreased values associated with aesthetic surroundings.

In areas of heavy gypsy moth outbreaks, recreational use of the forest and one's own backyard can be curtailed severely due to the presence of larvae and their droppings. Painting of homes must be curtailed in outbreak areas as larvae stick to painted surfaces and congregate in

sheltered places--under window ledges, porch roofs, door sills, and eaves. This necessitates repainting damaged areas.

Outdoors, sidewalks are avenues for migrating larvae. Individuals trying to use those surfaces step on larvae. Sidewalks become stained and caked with the remains of trampled caterpillars. Crushing them makes sidewalks both slippery and unsightly.

Larvae also migrate over driveways and roads. Vehicular traffic crushing larvae in an outbreak area can make roads slippery and dangerous, sometimes requiring highway department trucks to sand unsafe roads during July in the Northeast.

If no eradication action is taken against isolated infestations by State or local communities, gypsy moth populations, depending on local site conditions, are expected to thrive and become well established. The longer eradication action is delayed, the greater the opportunity for insect spread from the immediate site of the infestation into the surrounding area.

Regulatory action by APHIS and State agencies still would be implemented in the form of quarantines, inspections and treatment of materials and goods passing out of the quarantined area to stem the artificial spread of the insect. However, as the infested area enlarges through natural spread of the insect, increased manpower would be needed each year to maintain the quarantine. Additional impacts are presented by Galt (1983), who discusses the potential economic effects of a no action alternative in California.

Under such conditions, gypsy moth populations in areas having susceptible host material may remain at low levels for several years. Eventually, the populations will build to outbreak levels, causing defoliation or susceptible hosts and conditions similar to those described in the infested areas of the Northeast. During periods when population levels are high, expansion of isolated infestation will occur as a result of natural and artificial spread of the insect. This will occur despite the regulatory actions implemented to contain the spread.

So long as no eradication or suppression action is taken by State or local agencies, anxieties concerning the use of insecticides and human

health concerns would not occur. However, based on past experience, the presence of large numbers of gypsy moth larvae and associated defoliation on trees and shrubs would trigger public sentiment for nuisance abatement.

If State agencies or individuals attempt suppression, the biological effects of such would depend on the strategy used and would not differ from the effects previously discussed for each treatment alternative. However, suppression activities undertaken by individuals or communities without the benefit of coordination with a Federal/State-administered program may result in the application of more insecticide than is necessary, since most treatment financed by local communities or individuals entails the use of ground application equipment with varying rates of application.

Suppression or eradication activities undertaken by groups of residents seldom provide for involvement by, and notification of, adjacent residents or other people who might be interested in participating. Benefits derived from organizing a coordinated suppression approach, including maximized treatment efficiency and public safety, would not be achieved.

If the no action alternative results in no attempts by State, local communities, or individuals to suppress populations in infested areas, gypsy moth populations will continue to thrive and spread by natural and artificial means throughout all susceptible host types in the United States. The rate of spread can be expected to accelerate as more and more acres of host type become naturally and artificially infested.

Impacts on timber and ornamental shade trees will increase. The USDA Forest Service and APHIS will have difficulty in meeting the objectives of their statutory authorities contained in the Cooperative Forestry Assistance Act of 1978 and the Plant Quarantine Act of 1912 as amended, with regard to the gypsy moth.

CHEMICAL INSECTICIDES

The 1983 ruling by the United States District Court for the District of Oregon enjoined the USDA APHIS program from using the aerial application of carbaryl to eradicate gypsy moth from

populated areas of Oregon (Oregon Environmental Council versus Kunzman et al.) until a new EIS was prepared that considers, among other aspects, the health risks of spraying residential areas including the danger to children and others sensitive to chemicals. In addition, issues concerning the health risks of using chemical insecticides in general were identified during the scoping process conducted prior to development of the draft EIS. Many of the same issues were also reiterated in review comment letters to the draft EIS.

As would be expected, USDA found a paucity of documented scientific literature dedicated specifically to the study of the direct or indirect effects to humans from exposure to chemical insecticides used in gypsy moth or similar projects. Studies specific to sensitive populations (children, pregnant women, people sensitive to chemical insecticides, the elderly, and similar cohorts) were lacking. However, several studies involving exposure effects to volunteers and occupationally exposed individuals was available and subsequently used as a basis upon which to evaluate the significance of exposure to people in or near treatment areas.

While the acute effects of the chemical insecticides are well documented and accepted by the scientific community, the chronic or long-term effects of very low exposure levels are a source of uncertainty. The available literature suggests that there is considerable disagreement among scientists regarding the extrapolation of some test results to humans for effects such as mutagenicity, carcinogenicity, teratogenicity, and others. Much of this controversy lies in disagreements of the significance of intra- and inter-species differences in the laboratory subject animals, interpretation of results, and study design.

In order to address issues and concerns regarding use of chemical insecticides, the USDA developed an analysis of human health risks (to both general and sensitive populations) involving the use of acephate (Orthene®), carbaryl (Sevin®), diflubenzuron (Dimilin®), and trichlorfon (Dylox®) in gypsy moth suppression and eradication projects. The analysis relies on existing data where available and uses worst case assumptions where appropriate. This analysis complies with CEQ regulations (40 CFR 1502.22)

regarding gaps in relevant information or scientific uncertainty, and is appended to this EIS (Appendix F). Results of the analysis are summarized and presented in the discussions of the chemical insecticides which follow.

Efficacy and possible nontarget effects and risk to humans of any new insecticides that may become registered for gypsy moth control in the future will be addressed in environmental analyses conducted in accordance with NEPA for all projects for which their use may be proposed.

Acephate

General Information. Acephate, trade name Orthene®, is an organophosphate compound used as a contact and systemic insecticide. It has a cholinesterase inhibition mode of action (Chevron 1976). It is registered for use to control a broad spectrum of insects on ornamentals, trees, shrubs, and flowers.

Acephate is a white crystalline solid with a very low vapor pressure ($2x10^{-6}$ mm Hg at 25°C) and a very high solubility in water (65 percent).

Fate in Environment. Laboratory studies indicate that acephate is rapidly degraded in soil, primarily due to the action of microorganisms. Field and laboratory studies have shown that acephate rapidly degrades in plants (Chevron 1973). Generally, a 5- to 10-day half-life has been noted in plants (Chevron 1973). Willcox (1973) reported that after applications of up to 0.5 lb per acre, residues in leaves and litter dropped below 0.02-ppm (the limit of detection) in 33 days.

Acephate breaks down relatively slowly in water as the rate of hydrolysis is affected by temperature and alkalinity. The half-life in water at pH 7 and 70°F is about 50 days under laboratory conditions. In natural bodies of water, degradation would be accelerated by breakdown in aquatic vegetation and microorganisms in sediment (Chevron 1975).

From kinetic reaction studies, it has been determined that about 5 to 10 percent of acephate degrades into methamidophos which itself is a registered insecticide for use on certain lepidopterous larvae. Methamidophos is rapidly degraded in soil (Leary and Tutass 1968) and poses no threat for bioconcentration (Chevron 1973). The remaining acephate degrades directly into

innocuous salts (Tucker 1972). No other metabolites of toxicological significance have been observed (Tutass 1968).

Toxicology. Acephate will adversely affect some nontarget insects within treatment areas. The effects on nontarget insects from an aerial application of Orthene at 0.5 lb active ingredient per acre for control of the gypsy moth were monitored up to 1 month after treatment (LOTEL 1975). It was concluded that lepidopterous larvae, dipterous larvae, and Hymenoptera--predominantly the family Formicidae--were adversely affected. The order Coleoptera was least affected while dipterous larvae showed the greatest decline in numbers. A knockdown effect observed immediately after treatment affected all orders of arthropods collected; however, populations that were depressed recovered to pretreatment levels within 1 month, and none was eliminated. Acephate has been rated as being highly toxic to honey bees (Atkins et al. 1981).

In laboratory animals, the acute oral LD_{50} of acephate ranges from 866 to 945 mg per kilogram of body weight (mg/kg) (Meister 1983). No observable effect levels (NOEL's) have been established in laboratory animals for a variety of effects (see Appendix F, Table 3). Long-term feeding studies in rats (90 days to 28 months) and dogs (2 years) for detection of cholinesterase inhibition activity in plasma, red blood cells, and the brain have established a NOEL of 0.25 and 0.75 mg/kg/day, respectively. A NOEL of 2.5 mg/kg/day was established in dogs (2-year feeding study) for more pronounced systemic cholinesterase effects. NOEL's for teratogenic effects (birth defects) have been estimated to be above 10 and 200 mg/kg/day in rabbits and rats, respectively.

Estimated dose levels for animals resulting from acephate exposure in gypsy moth suppression and eradication projects is developed in Appendix F. The goat and rabbit have high surface area to body weight ratios that can be used as worst case representations for large and small animals (wildlife, livestock, domestic). Dose levels estimated in Appendix F for dermal and oral exposure are: 2.31 mg/kg [(0.202 mg/kg + 2.88 mg/kg) x 0.75 lb a.i./acre] for large animals, and 1.14 mg/kg [(0.403 mg/kg + 1.05 mg/kg) x 0.75 lb a.i./acre] for small animals. These exposure

levels are well below exposure threshold levels for any acute effects; however, they are above chronic exposure threshold levels for inhibition of cholinesterase activity (Appendix F, Table 3). It is possible that animals could experience a temporary decrease in cholinesterase activity if they were exposed to this dose level over a long period of time. These exposure scenarios are worst case assumptions that do not take into account the shielding effects of animal fur (similar to human clothing) nor do they take into account the ability of the animal to metabolize, detoxify, and excrete acephate.

Decreased cholinesterase activity in some animals has been shown. In 1976, acephate was applied at 0.5, 1.0, or 2.0 lb a.i./acre on Wallowa-Whitman National Forest in Oregon. The effect of acephate spraying on brain cholinesterase activity was evaluated in 14 passerine species. All dosages caused marked, widespread, and prolonged brain cholinesterase depression in passerine birds (Zinkl et al. 1979). Also, postspray bird census data suggested that 2 species of birds may have left the area following the treatments (Richmond et al. 1979). In 1977, acephate was applied at 0.5 lb a.i./acre on forested lands in Idaho for western spruce budworm control. Eleven avian species evaluated showed brain cholinesterase depression (Zinkl et al. 1980).

No human health problems have been demonstrated in the various field development programs in which acephate has been used. When used in accordance with label instructions, acephate poses no health hazard to persons formulating, spraying, or working in treated areas (Willcox and Coffey 1977). For example, a monitoring and medical study was conducted after several men were occupationally exposed to acephate in a plant where the material was being produced, and in a lab where large batches were formulated (Pack 1972). Urine samples were monitored for acephate and metabolites. Concentrations up to 5 ppm were detected in the urine and no adverse health effects were observed. Effects on blood cholinesterase levels, a sensitive indicator of organophosphate exposure, were not detected.

For the general public and occupational scenarios described in Appendix F, the realistic and estimated worst case exposure levels expected in gypsy moth suppression and eradication projects are all below the lowest established NOEL. For

sensitive populations such as children, pregnant women, the elderly, and individuals sensitive to chemicals, a 10x safety factor was applied to the calculated exposure levels (Appendix F, Table 13). In all cases involving dermal exposure only (direct and indirect), the realistic and worst case doses are below the lowest established NOEL. Dose levels calculated for sensitive individuals who receive dermal exposure and also consume food and water containing acephate residues are above the lowest NOEL established for inhibition of cholinesterase activity, but below the NOEL for more pronounced cholinesterase inhibition effects. It is possible that a temporary decrease in cholinesterase activity could occur based on the assumptions used in Appendix F. Exposure levels calculated for consumption of contaminated food and water by sensitive populations are very conservative estimates and as such are considered worst case estimates.

Accidents such as aircraft and tank truck spills have occurred in other aerial spray projects, although gypsy moth projects have an excellent track record in this regard. Estimated dermal exposure levels resulting from aircraft spills are well below the LD_{50} for acephate, but could conceivably cause a decrease in cholinesterase activity depending upon how quickly exposed persons bathe and change clothing. Any decrease in cholinesterase activity at these dose levels is temporary. The estimated probability of aircraft spills occurring on land is 5.1×10^{-4} or 0.00051 per aircraft load. The potential number of people (general public) that could be exposed to the incident is 3.5 (Appendix F, Table 12). Dermal exposures resulting from contact with insecticide as a result of a truck accident are estimated to be above the LD_{50}. Acute effects are expected with possible fatalities if protective clothing is not used. It is assumed that 2 workers and not the general public will be exposed to the incident. The probability of a truck spill occurring is estimated to be 1.08×10^{-5} or 0.0000108 (Appendix F, Table 12).

Drinking water that contains acephate resulting from the accidents is less hazardous due to the diluting effect of water. Realistic and worst case dose levels in water resulting from aircraft spills are below the lowest NOEL and below the established acceptable daily intake (ADI) for the realistic dose. No effects are expected as a result of drinking 2 liters of this water per day.

Realistic dose levels in water resulting from truck spills are below the NOEL, but the worst case dose is slightly above the NOEL. In this latter case, a temporary decrease in cholinesterase activity could occur from drinking 2 liters/day of this water over a long period of time. The probability of a truck spill releasing insecticide in water is estimated to be 1.2 x 10^{-6}. The probability that a truck spill would involve a worst case dose level is 0.0087. It is assumed that the number of people that could be exposed to this incident would be all of those who may drink the water (Appendix F, Table 12).

As demonstrated in the analysis of human health risks presented in Appendix F, there are no adverse human health effects identified for either the general public or occupationally exposed individuals as a result of using registered dose rates of acephate in gypsy moth suppression and eradication projects. Possible temporary effects are identified for sensitive populations based upon the worst case assumptions and exposure levels used in the analysis. These are a result of very conservative exposure estimates for consumption of contaminated food and water. The only major effects identified are associated with major insecticide release (probability of occurrence 10^{-4} to 10^{-6}), with a possible exposure to 2 to 3.5 people.

It is highly unlikely the registered use of acephate as applied to treatment areas during gypsy moth suppression or eradication project would pose any human health hazard.

Carbaryl

General Information. Carbaryl, trade name Sevin®, is a broad spectrum organocarbamate used as a contact and stomach insecticide. In its technical grade, it is an odorless white to gray colored crystalline solid. Its melting point is 142°C, its density is 1.232 g/ml at 20/20°C, and its flammability is described by a Cleveland Open Cup Flashpoint of 193°C (Union Carbide 1968).

Since it was developed in 1956, carbaryl has become one of the most widely used insecticides. About 25 million pounds were used in the United States in 1974 (Dolinger and Fitch undated). Most of it was used in agriculture, but about 3.75 million pounds were used around houses and in gardens. Such widespread use has prompted considerable investigation into effects which are now better understood than for most insecticides.

Fate in the Environment. Carbaryl is effective against members of most insect orders (Haynes et al. 1957; Barrett 1968). Insect species with more than 1 generation per year (USDA 1968) or with 1 generation with staggered development within the population often require repeated applications of carbaryl, because the chemical generally does not remain effective against the target insect for more than 1 or 2 weeks. The residue of carbaryl does have effective insecticidal property for several days after spraying. One study, showed that most saddled prominent larvae were killed within 48 hours of an application; however, larvae continued to die 8 days after spraying (Grimble et al. 1970). Skoog (1971) reported carbaryl effective at 18 days after treatment of grasshoppers. Residues of carbaryl, applied at 1 pound per acre as Sevin 4 Oil, remained high (causing 63 and 77 percent mortality in 2 groups of laboratory-reared gypsy moth larvae fed leaves from trees in a suppression area) at least 60 days after treatment. At 114 days mortality from the residues was 5 and 11 percent (Doane and Schaefer 1971).

Insecticide residues are degraded and diluted in the environment by a number of physical factors. For carbaryl, rain is a major factor in reducing residues (Union Carbide 1968). In Massachusetts, rain in excess of 1.8 inches occurred 12 to 24 hours after spraying with Sevin Sprayable®, and the original 190 ppm residue of carbaryl or its degradation product on dominant scrub oak foliage was reduced to about 15 ppm 3 days after spraying (Wells 1966). Chemical decomposition on plants is less important, and plants absorb only small amounts (Union Carbide 1968). Once carbaryl is in soil or water, however, chemical decomposition is dominant and promptly leads to less toxic degradation products.

The half-life of carbaryl residues is 3 to 4 days. Carbaryl, in a Sevin 4 Oil® formulation, was found to have a half-life of 8 to 10 days on range grasses (Fairchild 1970). On forest foliage, typical initial residues after treatment range from 30 to 100 ppm when carbaryl is applied for gypsy moth control. These decline to 5 to 20 ppm in 2 to 3 weeks (Back 1961). In Michigan, carbaryl (in that case, Sevin 4 Oil) applied at a rate of 1 pound active ingredient per acre on maple trees showed residues of 500 ppm 1 day after spraying, 116 ppm after 8 days, 130 ppm after 15

days and 43 ppm after 35 days (Fairchild 1970). In New York, the same treatment applied to 2 mixed oak stands gave 192 and 55 ppm the day of spraying to 112 and 15 ppm 25 days after spraying (Fairchild 1970). Sampling of forest foliage may reveal excessively high or low residues in contrast to variation on row crops. This is believed due chiefly to the varied terrain and air currents likely to be found over forested areas as opposed to agricultural crop land. Regardless of initial deposit, the rate of residue loss usually is constant.

In a monitoring study of a gypsy moth suppression project in which Sevin 4 Oil was applied at 1 pound per acre, exposed soil residues dropped below the detection limit (0.2 ppm) 128 days after spraying; the last samples showing residues had been taken at 64 days. Occasional samples of forest litter at 128 days still had slight residues (up to 0.65 ppm); but for most, residues had dropped below the limits of detection (Willcox 1972).

If carbaryl is applied unintentionally over open water such as small brooks or ponds, an initial deposit of 1 ppm or less in a water depth of about 4 inches may be expected to completely degrade or disappear in 1 or 2 days (Romine and Bussian 1971; Calif. Dep. Fish and Game 1963; Lichtenstein et al. 1966). Results were similar for water treated with Sevin 4 Oil during a gypsy moth suppression project (Willcox 1972). A proportionately lower concentration would occur in deeper water. More than 1 ppm in water is required to reach an LD_{50} value for fish. In a gypsy moth study, residues of 30 ppb in water dropped to 1.5 ppb in 1 day (USDA 1964).

Karinen et al. (1967) concluded that carbaryl reaching shallow mud flats in marine ecosystems probably would be rapidly removed from water by adsorption on bottom mud. Chemical degradation then occurs, with carbaryl and 1-naphthol likely to persist in mud for 2 to 6 weeks. Carbaryl as an 80 percent wettable powder was applied at 10 pounds per acre to a mud flat at low tide, simulating application for control of oyster pests. The initial residue (10.7 ppm) dropped rapidly the first day when the tide removed carbaryl and 1-naphthol not adsorbed on mud. The toxicant in the top inch of mud declined from 3.8 ppm to 0.1 ppm 42 days later.

Carbaryl decomposes or metabolizes to several substances, of which 1-naphthol and 1-naphthyl (hydroxymethyl) carbamate are the most important (Union Carbide 1969). The relative toxicities (LD_{50}) of carbaryl and these substances to male rats are: carbaryl, 500 mg/kg; 1-naphthol, 2,590 mg/kg; and 1-naphthyl (hydroxymethyl) carbamate, more than 5,000 mg/kg. The no-ill-effect levels over a 7-day period for the same 3 substances are 125 to 250 mg/kg, 500 to 1,000 mg/kg and 250 to 500 mg/kg, respectively.

Toxicology. Application of carbaryl for gypsy moth control is likely to adversely affect some beneficial insects. However, any reduction in nontarget insects that may occur as a result of carbaryl application is temporary (Karpel 1973; Moulding 1972). Johansen (1959) reported carbaryl as highly toxic to honeybees, though different formulations of carbaryl have different levels of toxicity. The difference in toxicity is due mainly to the manner in which these formulations dry on the target foliage, which, in turn, determines how readily the insecticide can be picked up by honeybees and transported to the hive. Apiaries can be protected by taking precautionary measures such as locating hives beyond bee-flight range until 1 week after application (Strang et al. 1968). Covering hives before treatment also can reduce losses (Jaycox 1963).

The registered use of carbaryl has no direct adverse effects on amphibians or reptiles or fish (Romine and Bussian 1971, Tompkins 1966; Willcox 1972; Pillow 1973).

During operational spraying in Maine (1.0 lb carbaryl/acre), acetylcholinesterase levels were depressed an average of 20 percent in brook trout (*Salvelinus fontinalis* Mitchill) and 35 percent in Atlantic salmon (*Salmo salar* C.) (Hulbert 1978). These depressions were detected within 24 hours of spraying and persisted throughout the sampling period (192 hours). During spruce budworm spraying in Maine (1.0 lb carbaryl/acre) in 1975, brook trout depressions ranged between 13 and 22 percent and returned to normal within 48 hours. Activity depressions in Atlantic salmon were more gradual (9 to 27 percent) and failed to return to normal within the same sample period (48 hours) (Marancik 1976).

A study of buffered streams by McCullough and Stanley (1980) during the 1979 Maine spruce budworm project indicated that feeding and acetylcholinesterase activity of young-of-the-year brook trout were not adversely affected. Ott and Wilder (1980) studied the effects of an application of 0.75 lb carbaryl/acre on young brook trout in 1 unbuffered and 1 buffered stream in Maine. No physiological changes in brook trout were detected that could be attributed to carbaryl contamination. In addition, these workers concluded that it was extremely unlikely that streams accidentally contaminated by carbaryl during spraying for spruce budworm control in Maine would have resulted in fish mortality.

Some aquatic insects in the orders Plecoptera (stoneflies) and Ephemeroptera (mayflies) are known to be highly sensitive to low levels of carbaryl. Trichoptera (caddisflies) and Diptera (true flies) also are sensitive to carbaryl. There may be a 50 to 100 percent reduction in aquatic insect populations in treated streams and ponds (Burdick et al. 1960). LOTEL (1977) reported that in a stream treated with 1.0 lb carbaryl/acre, each sampling station recorded a residue of at least 40 ppb and a peak residue to 80 ppb. The biological impact was indicated by increased drift of dead and dying stoneflies, mayflies, caddisflies, and true flies.

The effects of 2 consecutive years of spraying on other aquatic organisms appear similar to those observed in areas treated just once (Trial 1978, 1979; Courtemanch and Gibbs 1978). These effects include loss of stonefly species from individual streams, and altered generic assemblages for an indefinite period (Trial 1978, 1979). A study of buffered streams by McCullough and Stanley (1980) during the 1979 Maine spruce budworm spray project indicated that benthic invertebrate fauna were not adversely affected. Also, the numbers of drifting invertebrates were substantially lower than in previous years. The amount of long-term impact appears to be a function of species susceptibility and recolonization ability. Two consecutive years of spraying with carbaryl reduced populations of stonefly and susceptible mayfly genera to near zero.

Carbaryl lowers the cholinesterase levels in many animals. Cholinesterase splits acetylcholine, the chemical responsible for forming the bond

necessary to carry an impulse through the nervous system. If the acetylcholine is not split, the impulse is repeated again and again, and a severe lowering of cholinesterase will result in symptoms of nerve poisoning.

The acute oral LD_{50} is 500 to 850 mg per kilogram of body weight (mg/kg) (Meister 1983). No observable effect levels (NOEL's) have been established in laboratory animals for a variety of effects (Appendix F, Table 4). The lowest established NOEL is 2.0 mg/kg/day in pregnant dogs for teratogenic effects. Other established NOEL's for teratogenic effects in mice, rabbits, and rats range from 150 to 500 mg/kg/day.

Dermal and oral dose levels to animals (wildlife, livestock, domestic) resulting from carbaryl exposure in gypsy moth suppression and eradication projects are estimated to be 3.08 mg/kg (0.202 mg/kg + 2.88 mg/kg) for large animals and 1.45 mg/kg (0.403 mg/kg + 1.05 mg/kg) for small animals (Appendix F). These levels are well below acute exposure threshold levels and are below all exposure threshold levels for teratogenic effects except that established for pregnant dogs (Appendix F, Table 4). Major effects to animals are not likely because the threshold levels for teratogenic effects represent daily exposures over a long period whereas the estimated doses in gypsy moth projects are single day exposures.

Depression of cholinesterase activities has, however, been reported in birds. Depressed brain acetycholinesterase activity of forest birds was reported following application of 1.0 lb carbaryl per acre in Montana (Zinkl et al. 1977), while split treatments (0.31 and 0.69 lb carbaryl per acre) in Maine revealed no depression (Gramlich 1979). Observations by Connor (1960) on 49 species of birds exposed to carbaryl failed to reveal adverse effects on their behavior, conditions, or reproduction and rearing of young.

In a study of the response of breeding birds to an aerial application of carbaryl, Zinkl et al. (1979) reported no significant effects on the numbers of breeding birds, nesting success, mortality rates, or activities of brain cholinesterase. An indirect effect of carbaryl spraying to birds may be a depletion of available food, which alters bird activity (Doane and Schaefer 1971).

Harry (1977) compiled an extensive review of human exposure to carbaryl. Despite almost universal exposure in the United States over more than 20 years, it seems that the safety record of carbaryl is almost unparalleled by any other insecticide.

Potential exposure levels to the general public, sensitive populations, and occupationally exposed individuals (Appendix F, Tables 9 and 14) for the realistic and estimated worst case doses expected in gypsy moth suppression and eradication projects are all below the lowest established NOEL. No adverse human health effects to any group is indicated.

Dermal exposures resulting from aircraft spills are well below the established LD_{50}. It is possible that those potentially exposed (estimated 3.5 people) might exhibit symptoms of decreased cholinesterase activity depending upon how soon they bathe and change clothing following exposure. The probability that an aircraft spill would occur on land is estimated to be 5.1×10^{-4} or 0.00051 (Appendix F, Table 12). Dermal exposures resulting from contact with concentrated carbaryl (tank truck spills) are above the established LD_{50}. Acute effects are expected with possible fatalities if protective clothing is not used. It is assumed that only 2 project workers associated with spill containment, and not the general public, would be exposed to the incident. The probability of a vehicle accident occurring with the release of insecticide is estimated to be 1.08 $\times 10^{-5}$ or 0.0000108 (Appendix F, Table 12). Potential doses in water resulting from aircraft or tank truck accidents are all below the NOEL and no effects are identified from drinking 2 liters of water/day (Appendix F, Table 9).

In forest openings, actual dermal exposure studies conducted by the South Carolina Epidemiologic Studies Center (1979) during Maine's spruce budworm spray project showed a total dermal exposure of 10 mg carbaryl for a person (150 pounds) who is 80 percent clothed at the time of application.

In this study, the person respiratorily exposed for 2 hours in the spray area would receive only 0.054 percent carbaryl of the Time Weighted Average (TWA) standards. This equals a safety margin of 1,834 times the occupational exposure (personal communication, Ernest Richardson, Maine Bureau of Health).

In 1978 and 1979, field studies were conducted by the South Carolina Epidemiologic Studies Center to measure human exposure to carbaryl during spruce budworm suppression projects in Maine. The level of carbaryl residues found in urine samples taken during the 1978 project are shown in Table 3. The following quotations regarding 1978 results are taken from the Draft Interim Report (SCESC 1978):

> Human exposure to carbaryl applications during Maine's 1978 Spruce Budworm Suppression Project was monitored by the South Carolina Epidemiologic Studies Center. Except where there had been exposure to carbaryl from either mixing operations or home usage, none of the urine samples collected prior to application were found to contain the alpha-naphthol metabolite. Analyses of urine samples collected 12 to 24 hours after application found that the cohorts of pilots and aircraft loaders had the highest residues. About one-half of the samples from ecologists and rangers who were working and/or living in the application areas showed small but measurable levels of alpha-naphthol. Of the 49 urine samples collected from residents 12 to 24 hours after application, only 7 were positive for alpha-naphthol and ranged from 14 to 38 ppb. From the administration of health effect questionnaires, it was determined that no participant reported symptomatology thought to be related to carbaryl exposure.
>
> Data presented in the draft 1978 Maine Carbaryl Study report suggest that there were no apparent risks to those workers occupationally exposed to and individuals residing near areas aerially treated with carbaryl. Alpha-naphthol residues in the residential participants indicated that drift did not occur.

Because of continued public concern and the need to further investigate the amount of human exposure that results from an aerial application of carbaryl, a study was conducted in 1979 by the South Carolina Epidemiology Studies Center to monitor the exposure of humans to carbaryl by measuring the urinary metabolite, alpha-naphthol, in persons potentially exposed during the aerial application to forests and to relate this exposure to air sampling. Results of 1979 urine residue

Table 3. 1-Naphthol residues in urine samples from persons exposed to Sevin 4 oil in 1978. 1/ 2/

Exposure group	Number of tested participants	Number of urine specimens tested	Number tested positive	Range of positive tests (ppb)	Median residue level of positive tests (ppb)	Average residue level of positive tests (ppb)
Pilots	5	10	10	41.00-1750.00	121.50	323.89
Loaders	5	9	8	79.00-5540.00	656.00	1144.21
Ecologists	9	17	8	14.00-146.00	28.66	51.87
Wardens/ rangers/wives	11	11	5	11.11-25.00	12.14	16.85
Scouts	10	10	4	10.77-23.00	14.58	15.73
Lab technician	11	11	3	11.25-16.25	13.68	13.73
Residents	42	50	7	10.00-37.60	14.00	15.63
EPA/safety	5	6	5	23.00-1250.00	89.14	313.99

1/ Urine 1-naphthol residue analysis; lowest level detectable by this method is 10 parts per billion (ppb).

2/ From Draft 1978 Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1978. South Carolina Epidemiologic Studies Center, Medical University of South Carolina, March 1979. (Used by permission of EPA.)

Table 4. 1-Naphthol residues in urine samples from persons exposed to Sevin 4 oil in 1979. 1/ 2/

Exposure group	Number of tested participants	Number of urine specimens tested	Number tested positive	Range of positive tests (ppb)	Median residue level of positive tests (ppb)	Average residue level of positive tests (ppb)
Pilots	2	2	1	156.87		156.87
Ecologists	3	3	1	25.75		25.75
Scouts	6	6	4	10.42.17.90	12.80	13.48
Ranger/family	6	6	2	29.11-62.46	45.78	45.78
Field technician	7	7	2	14.23-187.48	100.86	100.86
Residents	16	16	5	24.00-2556.0 3/	199.40	615.97
Safety	1	1	1	3029.00 4/		3029.00

1/ Urine 1-Naphthol residue analysis; lowest level detectable by this method is 10 parts per billion (ppb).

2/ From Draft Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1979. South Carolina Epidemiologic Studies Center, Medical University of South Carolina, November 1979. (Used by permission of EPA.)

3/ The 2556.00 figure is probably due to the use of a home garden dust containing carbaryl.

4/ Twelve to 24 hours after a second intense dermal exposure.

analyses are shown in Table 4. The following quote regarding results of this work is from their draft interim report (SCESC 1979):

> The National Institute of Occupational Safety and Health (NIOSH) has established a time weighted average (TWA) for occupational exposure to carbaryl. The TWA is a maximum exposure limit for occupational exposed employees based on a 10-hour work shift, 5 mg/m^3. The TWA, when compared to the air sampling results of the Washburn area, indicates that the residents located 0.6 miles north of spray block 6-14 were exposed to carbaryl concentrations in the magnitude of thousandths of one percent of the permissable occupational level. The highest reported level of carbaryl equivalent was found at Site 1 during the first 12 hours of sampling after application. This level (341.0 ng/m^3) when converted to milligrams equals 0.0003 mg/m^3 or 0.006 percent of the TWA standard. Thus the exposure of residents to carbaryl concentrations in environmental air throughout the sample period was the smallest fraction of allowable levels mandated for more intensive occupational exposure.

In the 1979 study, individuals who remained indoors during a nearby application of carbaryl were found to have no detectable alpha-naphthol, a metabolite of carbaryl, in their urine with the exception of one person who may have been previously exposed to another source of carbaryl or the insecticide malathion. Persons outdoors at the same location were found to have detectable levels. The same study indicated that persons entering spray blocks more than 24 hours after carbaryl application probably would have a 5 percent or less chance of receiving detectable exposure to carbaryl (personal communication, Dr. Sandifer, South Carolina Epidemiologic Studies Center).

In 1978 the New Jersey Department of Health, Epidemiologic Studies Program-Pesticides, monitored people residing in gypsy moth treatment areas. The study site consisted of approximately 23 acres of heavily wooded residential land containing approximately 80 dwellings. Following carbaryl application, researchers were unable to detect the presence of a metabolic indicator of

carbaryl in the urine of homeowners residing in the treatment area. By contrast, pesticide mixing and loading personnel exhibited levels of the indicator metabolite. However, a study of carbaryl formulators, conducted by the New Jersey Epidemiologic Studies Program during 1967-73, found no relationship between excessive and long-term exposure to carbaryl and chronic adverse health effects (NJESP 1974). The 1978 study further suggested that individuals who remain indoors during insecticide application receive no measurable exposure to the material. The report, presenting the 1978 study results as submitted to EPA, concluded that the aerial application of carbaryl to communities as conducted resulted in no measurable threat to human health (Schulze 1979).

Results from the studies in Maine (SCESC 1978, 1979) and New Jersey (Schulze 1979) indicate that, while precautions can be taken to reduce the number of people exposed and the amount to which they are exposed, it is not possible to avoid exposing some people to carbaryl during the spray operation. However, the amount of carbaryl is extremely small and exposure can be further minimized by remaining indoors or outside of the treatment areas during application.

Acute toxicity to people is rarely a problem with carbaryl. Comer et al. (1975) reported that plant workers producing carbaryl are exposed dermally to average levels of 73.9 mg/hr and respiratorily to 1.1 mg/hr of work. Urine samples of plant workers had concentrations of 8.9 ppm 1-naphthol, a metabolite of carbaryl, with average excretion rates of 0.5 mg/hr. In the same study, the exposure levels of spray applicator workers were studied. Average carbaryl levels were 59 mg/hr dermally and 0.09 mg/hr respiratorily. Comer et al. (1975) concluded that at these dose levels, concerns about acute toxic effects are minimal. Controlled human studies with carbaryl have been conducted at dosages sufficient to cause significant adverse effects. One investigation showed that a daily administration of carbaryl to human volunteers at 0.06 and 0.13 mg/kg/day for 6 weeks caused only slight signs and symptoms attributable to the insecticide (Wills et al. 1969).

Carbaryl is not a chronic poison. Test animals can tolerate a substantial percentage of an acutely toxic dose in the diet daily for a

lifetime. Levels causing no significant effect are as high as 400 ppm dietary to the mouse, equal to 60 mg/kg body weight daily, or 200 ppm to the rat, equal to 10 mg/kg (personal communication, R.C. Back Union Carbide Agricultural Products Company). These levels are well below the estimated maximum exposures from realistic and worst case doses associated with gypsy moth suppression and eradication projects (Appendix F).

There is some evidence suggesting that carbaryl may have teratogenic potential (causes birth defects). In a study with mice, Innes et al. (1969) showed effects at 5 mg/kg/day of body weight, which probably was about 14.2 ppm (Dolinger and Fitch, undated). The lowest dose that caused teratogenicity in dogs (Smalley et al. 1968) was 6.25 mg/kg/day or 17.8 ppm per day in the diet; no effect was observed at 3.25 mg/kg/day or 8.9 ppm. In gypsy moth projects, the exposure levels, realistic and worst case, estimated for the general public, sensitive populations, and occupationally exposed individuals are well below the lowest established NOEL for teratogenic effects (Appendix F, Tables 9 and 14).

The question of potential teratogenic effects in humans is addressed in a letter dated May 16, 1979, from Mr. Douglas D. Campt, Director of Registration Division, EPA, to Mr. William M. Cranston (now retired), N.J. Department of Agriculture. The letter includes the following statement:

> Since experimental exposure to carbaryl has caused birth defects in dogs, carbaryl may have some potential to do so in humans, and the Environmental Protection Agency is currently attempting to assess that potential. However, since a teratogenic study of carbaryl in rhesus monkeys was negative, it would appear that the teratogenic potential in humans, if any, is not great. One can never conclude that risk from exposure to any chemical is zero, and it is only reasonable and prudent to suggest that women who may be pregnant should avoid any unnecessary exposure to carbaryl and other chemicals. This is easily accomplished in the use of carbaryl by remaining indoors or under suitable cover at the time the application is made. Once the spray settles, any further potential for exposure is greatly reduced, and should be of no concern.

Halpin (1980) investigated the possibility of increased birth defects (teratogenicity) in New Jersey municipalities where carbaryl was aerially applied for gypsy moth suppression and whether or not a relationship in time between the occurrence of birth defects and this spraying existed. Although this was not an exhaustive study of birth defects in the 3-county area examined, it did provide a basis for concluding that there was no association between the spraying of carbaryl (Sevin 4 oil) for gypsy moth and the birth defects reported from Cape May County.

The carrying agent and emulsions of the Sevin 4 Oil formulation, as with other insecticides, are a trade secret. However, investigations have shown that the formulation contains no significant quantities of polynuclear aromatics which are compounds suspected of being carcinogenic. Nonionic polymers of polyoxyethylene ethers and nonyl phenol substances, which have been implicated in Reye's Syndrome, are not present.

The question of viral potentiation of Sevin 4 Oil recently was studied by two University of Maine researchers. Their data suggest that viral potentiation may be associated with exposure to Sevin 4 Oil. The Maine Bureau of Forestry appointed a panel of medical experts to review this study and to make recommendations concerning the potential health effects of Sevin 4 Oil. They concluded that Sevin 4 Oil poses a "potential but inconclusive health risk" and recommended that the Maine Bureau of Forestry develop more stringent limitations so that "no uninformed or unconsented human exposure will occur during a forest spray operation." A followup study was undertaken to determine the component of the Sevin 4 Oil constituents that may be viral enhancing. The data indicate that the active ingredient, carbaryl, is responsible for the viral enhancement. The medical advisory panel reviewed these new findings and felt that the original recommendations were still valid.

Viral enhancement has only been demonstrated in laboratory tissue culture. Tests in 26 species of animals have not demonstrated any carbaryl enduced viral enhancement (statement by Antoine Puech, Union Carbide, Salem, Oregon, Gypsy Moth Public Hearing Record, 1982).

Under laboratory conditions, carbaryl has been reacted with nitrite compounds in the presence of an acid catalyst and heat, to form N-nitrosocarbaryl. This laboratory synthesized N-nitrosocarbaryl has been used in several laboratory test systems to demonstrate its potential mutagenic properties. Such diverse test systems as microorganism bioassays, cell cultures, bone marrow, and transplacental host-mediated trials have been conducted (Uchiyama et al. 1975; Elespuru and Lijinsky 1973; Siebert and Eisenbrand 1974). Stomach cancer and local sarcomas have been produced in rats when laboratory-synthesized N-nitrosocarbaryl was used in feeding studies or when subcutaneously injected (Eisenbrand et al. 1975; Lijinsky and Taylor 1976). However, repeated dermal applications failed to produce skin tumors in the same species.

Since repeated dermal exposures did not produce skin tumors, oral exposure was investigated. It is thought that oral exposure to N-nitrosocarbaryl occurs by carbaryl (in the form of residues) and sodium nitrite (in saliva or food) combining in the stomach under acid conditions. In studies with guinea pigs, the formation of N-nitrosocarbaryl was reported when sodium nitrite and carbaryl were present in the stomach (Rickard et al. 1979). However, the _in vivo_ production of N-nitrosocarbaryl was less than 0.2 percent of that obtained from the _in vitro_ production. Further, the low pH of the guinea pig stomach, which is similar to the human stomach, causes the N-nitrosocarbaryl to become rapidly denitrosated to form carbaryl. In other laboratory feeding studies, high levels of physically mixed nitrite and carbaryl did not produce a significant increase in tumors or other lesions in either pregnant or nonpregnant rats or the exposed progeny (Lijinsky and Taylor 1977). Other laboratory studies were conducted with rats and mice to determine the oncogenic potential of carbaryl. Significantly, these studies did not produce oncogenicity attributable to carbaryl even though many were conducted at or near the maximum tolerated dose for up to 2 years. N-nitrosocarbaryl can cause mutagenic and carcinogenic effects. When found in the living body, it is unstable and the quantity is insufficient to cause carcinomas as demonstrated by these studies. The EPA review of the nitrosocarbaryl issue is presented in Appendix C.

A discussion on the probability of the occurrence of cancer from use of carbaryl in gypsy moth suppression and eradication projects is presented in Appendix F. Using existing data for N-nitrosocarbaryl and worst case assumptions, the probability of occurrence of cancer for the maximum exposed individual (MEI) based upon estimated lifetime exposures in suppression and eradication projects is calculated (Appendix F, Table 18) to be 4.05×10^{-9} and 2.43×10^{-9}, respectively. These probabilities are comparable to the lifetime increase in death from not fastening a car seat belt (Appendix F, Table 21). The incidences of cancer per acre per lifetime number of applications for the MEI is estimated to be 5.7×10^{-8} for suppression projects and 3.4×10^{-8} for eradication projects.

Following an extensive review of available studies relating to the insecticide carbaryl, the EPA has concluded that further restrictions of pesticide products containing carbaryl were not warranted. A summary of that decision is presented in Appendix D of this FEIS. In view of the existing data and the results of the analysis of human health risks presented in Appendix F, it is highly unlikely that the registered use of carbaryl, as applied to treatment areas during gypsy moth suppression or eradication projects would pose a human health hazard.

Diflubenzuron

General Information. Diflubenzuron, trade name Dimilin®, acts as an insect growth regulator by interfering with the synthesis of chitin, a protein found in the body wall of insects. The primary effect is by ingestion, but there is minimal contact action. Diflubenzuron slowly acts during the gypsy moth larval stage causing the body wall of the insect to rupture during the molting phase. The current EPA label interpretation restricts the use of Dimilin 25W --the formulation of diflubenzuron used for gypsy moth control--to forested areas with 1 house or less per 10 acres. Diflubenzuron also is registered for control of cotton boll weevil, several insects on soybeans, and mosquito larvae.

It is a white crystalline solid almost insoluble in water (about 0.2 ppm) and apolar solvents. In most polar to very polar solvents the solubility is moderate to good.

Fate in Environment. Diflubenzuron is rapidly degraded (3 to 4 days) in soil. The degradation was unrelated to soil type but was very much dependent on both the microbial activity in the soil and the particle size of the diflubenzuron

(Willcox and Coffey 1978). Studies at Brigham Young University (Pintar et al. 1975) showed that all soil bacteria could utilize diflubenzuron as a sole carbon or sole carbon and nitrogen source.

The persistence of diflubenzuron in water and soil-water systems is, as with soil alone, related to the microbial activity and the particle size of the material applied. With agricultural soils, the half-life in hydrosoils is 0.5 to 1.0 weeks for the parent compound and 8 weeks for the entire radiocarbon residue (Willcox and Coffey 1978).

Toxicology. Studies have been conducted on the effects of diflubenzuron on a number of nontarget species in the forest ecosystem (USDA 1975; Willcox and Coffey 1978).

In these studies, several different forest ecosystems were treated with diflubenzuron at rates from 0.03 to 0.06 lb active ingredient per acre. Following application, soil microbes and invertebrates, terrestrial insects, aquatic insects and other nontarget crustaceans, fish, small forest mammals, and birds were monitored for the effects of treatment. No treatment-related effects were observed with elements of the soil community, including soil microbes and fungi, soil inhabiting mites, and collembolans. It was shown that diflubenzuron at the rates applied had no effect on the organisms that are involved in the degradation and use of the forest leaf litter. In the studies of terrestrial insects, the single application of diflubenzuron had no effect on the free-flying, forest-inhabiting insects. Honeybees were unaffected when hives were placed directly within test areas. The effects monitored included honey production, egg production by the queen, and brood hatch development and survival (Willcox and Coffey 1978). Even though potential exposure to insectivorous small mammals and birds was possible, no treatment related effects were observed. Species composition and territorial distribution remained unchanged (Willcox and Coffey 1978).

Other studies have been conducted in aquatic habitats to determine the effect of diflubenzuron on aquatic insects and nontarget crustaceans (Mulla et al. 1975; Steelman et al. 1975; and Miura et al. 1975). Diflubenzuron has been found to reduce populations of certain sensitive nontarget crustaceans, primarily water fleas, cyclops and immature copepods, and certain species of aquatic insects (mayflies, corixids, and notonectids).

The effect on the aquatic environment is extremely variable and, although the species diversity in this habitat often is altered, populations of the nonsensitive forms adjust the overall community numbers to counteract the effects. Therefore, the limited environmental impact due to the nonpersistence of diflubenzuron is short lived and population recovery of the more sensitive species occurs within 14 to 28 days in most cases (Willcox and Coffey 1978).

The acute toxicity of diflubenzuron to mammals has been investigated by Phillips-Duphar B.V., Harris Laboratories, and the Huntingdon Research Center (Willcox and Coffey 1978). Because of its mode of action, the interruption of chitin synthesis on the insect, diflubenzuron has low mammalian toxicity. Diflubenzuron (40 mg technical) was shown to be a marginal eye irritant, but 50 mg in an aqueous gum tragacanth solution was not irritating. When diflubenzuron was tested for dermal effects, it was found to be nonirritating. The very low toxicity of diflubenzuron for mammalian and nonmammalian species exclusive of insects and certain chitin containing arthropods is in part related to the ability of the compound to be absorbed by the animal exposed and its ability to biochemically detoxify and eliminate diflubenzuron from its system (Willcox and Coffey 1978).

The acute oral LD_{50} in laboratory animals for diflubenzuron is greater than 4,640 mg per kilogram of body weight (mg/kg) (Meister 1983). No observable effect levels (NOEL's) have been established in laboratory animals for a variety of effects (Appendix F, Table 5). In long-term feeding studies in rats, mice, and rabbits, the lowest NOEL established is 4 mg/kg/day. This NOEL is for teratogenic effects. Other NOEL's established range from 40 to 100 mg/kg/day for other effects.

Dermal and oral dose levels for large and small animals (wildlife, livestock, domestic) resulting from exposure to diflubenzuron in gypsy moth suppression and eradication projects are estimated to be 0.185 mg/kg [(0.202 mg/kg + 2.88 mg/kg) x 0.06 lb a.i./acre] and 0.087 mg/kg [(0.403 mg/kg + 1.05 mg/kg) x 0.06 lb a.i./acre], respectively (Appendix F). These dose levels are well below estimated exposure threshold levels (Appendix F, Table 5). No effects to animals are identified.

For the general public, sensitive individuals, and occupationally exposed workers, the realistic and estimated worst case exposure levels expected in gypsy moth suppression and eradication projects are all below the lowest established NOEL for diflubenzuron (Appendix F, Tables 10, 12, 15, and 17). Dermal exposure levels resulting from aircraft and tank truck spills are well below established acute thresholds, and exposure levels resulting from consumption of contaminated water are below the lowest established NOEL for both realistic and worst case dose assumptions.

As demonstrated in the analysis of human health risks presented in Appendix F, there are no adverse human health effects identified for the general public, sensitive populations, and occupationally exposed individuals as a result of using registered dose rates of diflubenzuron in gypsy moth suppression and eradication projects. Furthermore, no effects are expected to either group as a result of contact with insecticide release from aircraft or tank truck accidents (probability of occurrence, 10^{-4} to 10^{-6}). It is highly unlikely that the registered use of diflubenzuron as applied in gypsy moth projects would pose a human health hazard.

Trichlorfon

General Information. Trichlorfon, most commonly known as Dylox®, is an organophosphate chemical that is used as an insecticide and as a therapeutic drug to treat selected endoparasites in humans and livestock (Abdalla et al. 1965; Beheyt et al. 1961; Davis and Bailey 1969; Wegner 1970). Trichlorfon also is registered for use on beef and dairy cattle for the control of ectoparasites (EPA 1969). The insecticide trichlorfon is registered for use on a variety of field crops, vegetables, seed crops and ornamentals. It is effective for control of many different species of insects with contact and ingestion modes of action. Technical trichlorfon is a white crystalline solid with a specific gravity of 1.73 at 20.4°C. Solubility is 12 percent in water at 26°C and it is soluble in alcohols and ketones.

Fate in Environment. Trichlorfon is rapidly degraded in the environment. In New York (Judd et al. 1972), trichlorfon was found in small amounts in water samples collected immediately after spraying, but the concentration of the chemical dropped below a detectable level 4 days after spraying; the half-life of trichlorfon in water at 30°C was 4.7, 0.6, and 0.1 days at pH levels of 5, 7, and 9, respectively. In this test, water was

protected from light. In an outdoor pond (pH 7.0) at temperature 20°C, and with exposure to sunlight and wind, trichlorfon showed a half-life of only 0.3 day (Chemagro 1971).

Doane and Schaefer (1971) found that gypsy moth larvae that were fed leaves collected 12 days after treatment experienced only 2.5 percent mortality. After an application of 1.0 lb trichlorfon per acre in New York for gypsy moth, Weiss et al. (1973) reported that residual levels dropped sharply within a few days after treatment, and by 60 days had reached the following percentages of their initial levels: 15 in leaves, 5 in litter, 10 in unexposed soil, and less than 1 in exposed soil.

Toxicology. Trichlorfon has shown no significant adverse effects against vertebrates, birds, reptiles, amphibians, and fish (Lewallen and Wilder 1962; Pearce 1970; Chambers 1972; Caslick and Smith 1973; Finger and Werner 1973; and Todaro and Brezner 1973). Bird activity may be temporarily altered through the reduction of insects available for food (Doane and Schaefer 1971; Caslick and Cutright 1973). Trichlorfon is classified as having a low toxicity for bees (Johansen 1959). Trichlorfon residues are not transported by foraging bees from contaminated surface into hives (Gilpatrick and Terrill 1970).

When used in accordance with the label, trichlorfon applied at dosages used for gypsy moth treatment will reduce populations of some nontarget insects, including some parasites and invertebrate predators. These nontarget insect populations recover, some within a few weeks (Chemagro 1968).

The acute oral LD_{50} of trichlorfon established in laboratory animals ranges from 150 to 400 mg per kilogram of body weight (mg/kg) (Meister 1983). No observable effect levels (NOEL's) have been established in laboratory animals for a variety of effects (Appendix F, Table 6). The lowest NOEL established is 1.0 mg/kg/day for a decrease in cholinesterase activity in young dogs. A 3-month to 2-year feeding study in dogs established a NOEL of 1.25 mg/kg/day for decreases in cholinesterase activity. A similar feeding study in male rats established a NOEL of 2.5 mg/kg/day.

Dermal and oral dose levels for large and small animals (wildlife, livestock, domestic) resulting from exposure to trichlorfon in gypsy moth suppression and eradication projects is estimated to be 3.08 mg/kg (0.202 mg/kg + 2.88 mg/kg) and 1.45 mg/kg (0.403 mg/kg + 1.05 mg/kg) (Appendix F). These one time exposure levels are below all established exposure threshold levels for major effects (Appendix F, Table 6). The exposures exceed thresholds established in young dogs, adult dogs, and rats for reduction in cholinesterase activity. Temporary reduction in cholinesterase activity is possible based upon the worst case assumptions used in Appendix F. The analysis does not account for the shielding effect of animal fur and represents a one time exposure. The established exposure threshold levels represent long-term daily exposures.

For the general public and occupational scenarios described in Appendix F (Table 11), the realistic and estimated worst case exposure levels expected in gypsy moth suppression and eradication projects are all below the lowest established NOEL. No adverse effects are identified. For sensitive populations such as children, pregnant women, the elderly and individuals sensitive to chemicals, a 10x safety factor is applied to the calculated exposure levels (Appendix F, Table 16). In all cases involving dermal exposure only (direct and indirect), the realistic and worst case doses are below the lowest established NOEL. No adverse effects are identified.

Worst case dose levels calculated for sensitive populations who receive dermal exposure and also consume food and water containing trichlorfon residues are above the lowest NOEL established for reduction of cholinesterase activity, but are below the NOEL established in rats for cholinesterase inhibition effects. It is possible that a temporary decrease in cholinesterase activity could occur based on the assumptions used in preparing the risk analysis (Appendix F). Exposure levels calculated for consumption of contaminated food and water by sensitive populations are very conservative estimates and as such are considered worst case assumptions. The probability of a worst case dose being applied is calculated to be 0.0087 per project.

Dermal exposures resulting from aircraft spills are below LD_{50}; however, they are high enough that some effects are possible depending upon how soon after exposure individuals bathe and change

clothing. For the realistic dose, dermal (partial) exposure, decreased cholinesterase activity is possible. For the worst case dose assuming full dermal exposure fatalities are possible. The probability, to the potentially exposed population (3.5 people), of an aircraft spill occurring is 5.1×10^{-4} or 0.00051 for the realistic dose (Appendix F, Table 12). The probability that an aircraft spill would involve a worst case dose is 0.0087.

Dermal exposures for the realistic and worst case dose resulting from spills of concentrated trichlorfon (vehicle accident) are both above the established LD_{50}. Fatalities are probable if protective clothing is not used. It is assumed that only project personnel (2) and not the general public would be dermally exposed to the spill. The probability of such an incident occurring is 1.08×10^{-5} or 0.0000108 (Appendix F, Table 12).

Consumption of water contaminated with trichlorfon as a result of aircraft or tank truck spills will not cause adverse health effects. All exposure levels are below the lowest established NOEL (Appendix F, Table 11).

Trichlorfon has been suspected of being a mutagen in several bacteriological studies _in vitro_ and _in vivo_, and teratogenic when given orally to rats. If trichlorfon is a teratogen, it does not appear to be a potent one. Staples et al. (1976) found positive results in rats, but only at high doses--432 or 519 mg/kg. Martson and Voronina (1976) found embryotoxic and teratogenic effects in rats from an 80 mg/kg dose, but none from an 8 mg/kg dose, administered during a critical period of embryogenesis. The exposure levels calculated in Appendix F for all population groups are well below the lowest NOEL established (8 mg/kg/day) for teratogenic effects. Since trichlorfon is a suspect mutagen, it may be a suspect cancer risk. The probability of cancer to the maximum exposed individual (MEI) in a 70-year lifetime from exposure to trichlorfon as used in gypsy moth suppression and eradication projects is presented in Appendix F (Table 18). The probability of cancer occurring is estimated at 10^{-6} or 0.000001 for both project types. These probabilities are comparable to the estimated lifetime increase in death from drinking a nondiet soft drink (Appendix F, Table 21). Cancer risk from trichlorfon is probably much less because of the need to use

worst case data assumptions for lack of established data. Existing literature (Fishbein 1978) suggests that it is breakdown products of trichlorfon and not the parent compound that are suspect mutagens.

Given the data available and the results of the analysis of human health risks in Appendix F, it is highly unlikely the registered use of trichlorfon as applied to treatment areas during gypsy moth suppression or eradication projects would pose a human health hazard.

BIOLOGICAL INSECTICIDES

In reviewing the available literature, USDA found no reports of any adverse effects attributable to the biological insecticides. The scientific data base is replete with studies describing the safety of these materials to nontarget organisms. During the environmental analysis conducted by USDA, no issue or concerns were raised during scoping activities suggesting human health uncertainty with the use of biological insecticides. Furthermore, no human health uncertainty was identified in any review comment letters to the draft EIS. In preparation of this FEIS, USDA identified no relevant data gaps or scientific uncertainty relative to the biological insecticides that would impede a reasonable choice among the alternatives.

Two biological insecticides currently are registered for use against gypsy moth by EPA. These are the bacterium *Bacillus thuringiensis* Berliner (*B. t.*) and the gypsy moth nucleopolyhedrosis virus (NPV). *B. t.* is an aerobic, spore-forming, crystal-producing member of the bacterial genus *Bacillus*. NPV is a naturally occurring virus of the gypsy moth that causes polyhedrosis or wilting. Field research has been conducted and is continuing on the purification, formulation, and use of NPV. Subsequently, only various formulations of *B. t.* are currently available for gypsy moth management.

Studies on the fate of *B. t.* in the environment indicate that *B. t.* spores will persist in soil for several weeks depending on the soil type, soil flora, and on factors such as pH, moisture, and solar radiation. A study of soils treated with *B. t.* applied for vegetable pest control concluded that spores can remain viable for long periods (over 3 months), and that the organism can

germinate and compete vegetatively in the soil and sporulate successfully under favorable soil conditions (Saleh 1969). The crystal is proteinaceous; degradation by the enzymatic action of soil flora can be presumed.

Survival of B. t. on leaves is minimal when no additives are included in sprays (IMC 1969). New formulations designed to protect B. t. from the ravages of environmental forces have shown considerable biological activity after 21 days of field exposure, and negligible biological activity after 1 month.

Inasmuch as B. t. is exempted from tolerance, no residue analysis on food or feed has been performed when B. t. has been used for forest-insect control (Heimpel 1971).

Laboratory-produced gypsy moth NPV has no degrading effect on the environment in which it is applied. It has a shorter residual persistence on bark and in the soil than the NPV occurring naturally in gypsy moth populations (Lewis et al. 1979).

Toxicology

Biological insecticides must be ingested by the gypsy moth larvae to be effective; therefore, larval mortality is not immediate. Larvae generally cease feeding after ingestion of B. t.; however, mortality may not occur until several days to more than a week later. Recent field projects have demonstrated that a single application of B. t. at a dosage rate of 12 BIU/acre can be effective in achieving the objectives of most suppression projects. More than one application of B. t. may be needed in certain situations to achieve suppression or eradication objectives. Generally speaking, proper B. t. application can be expected to reduce gypsy moth populations by 80 percent and achieve 70 percent foliage protection. A word of caution on the potency of the various formulations of B. t. is warranted: due to the processes used in producing this material, there is a ±30 percent variation in potency. Operational use of B. t. for use in eradication projects is discussed under the IPM alternative.

The gypsy moth NPV must be ingested to be effective. Field studies continue to evaluate the effectiveness of the NPV; however, the material needs further evaluation before being used in

operational projects. On the basis of field tests, proper application of gypsy moth NPV has been shown to reduce the residual number of egg masses by 75 percent, and also may reduce egg viability in the succeeding year. NPV also can be expected to achieve 50 to 70 percent foliage protection (Lewis et al. 1979).

In the formulations used for gypsy moth suppression and eradication, *B. t.* is a lepidoptera-specific insecticide; therefore, only insects in the Order Lepidoptera are affected by it. While lepidopterous larvae other than the gypsy moth may be affected, there will be no effect on beneficial insects such as bees (Lewis et al. 1979).

Test results reported by International Minerals and Chemical Corporation indicate that *B. t.* has no adverse effect on wildlife (IMC 1969). Doane and Hitchcock (1964) stated that *B. t.* appeared to cause negligible damage to vertebrate wildlife.

An oral acute toxicity study was conducted with *B. t.* on young adult bobwhite quail. The acute oral medial lethal dosage exceeded 10 gm/kg body weight (IBT 1970b). Five male and 5 female quail were fed 10 gm/kg by gavage. A similar group was fed distilled water as control. At the end of the 21-day test period, all animals were sacrificed and subjected to a gross pathological examination. No pathology attributable to the test material was found. Growth rate was similar in the test and control groups.

B. t. administered by mouth as the spore-crystal complex to rats daily for 3 months at rates of 25, 100, and 400 mg/kg produced no main function disorders or organ damage. Similar results were obtained in dogs fed 6, 25, and 100 mg/kg for 3 months (Fisher and Rosner 1959; Corlett 1961).

Fed to groups of 10 mice (16 to 25 gms.) at the rate of 10 g/kg *B. t.*,(Dipel®) caused no mortality. LD_{50} was beyond 10 g/kg (IBT 1970a). *B. t.* (Dipel) was fed to 3 female mongrel dogs at a dosage of 400 mg/kg. The animals were free of any symptoms during the 48-hour observation period (IBT 1970a).

In a test by Briggs and Goodrich (1959), 17 pheasants and 2 partridges, all about 6 weeks old, were divided into 2 groups. One group was fed 1.0

gm of B. t. per bird per day in 2 gelatin capsules. The control groups were fed 2 empty gelatin capsules daily. No deaths or symptoms of respiratory, alimentary or other disturbances were noted in the group that was fed B. t. Two pheasants in the control group died of trauma (due to handling). Birds in both groups exhibited feather color and pattern, bearing, and weight gain that are expected in similar groups of birds in nature. It was concluded that there were no differences in behavior or development between the test and control birds. A long-term study with 6 New Hampshire Red laying hens was conducted over a 23-month period. The hens received a daily dose of B. t. ranging from 0.5 to 10 gms per bird. Results showed no allergic response, other illnesses, or variations in the expected egg production of the hens. There were no significant differences between the test birds and the birds used as controls. In a 9-week oral toxicity test administered to 24 groups of 10 chicks each, no significant differences were noted between the test and control groups of chicks (Fisher and Rosner 1959).

Eighteen humans each ingested 1 gram of Thuricide® daily for 5 days. Complete physical and laboratory examinations were given before the experiment, at the end of the 5-day ingestion period, and 4 to 5 weeks later. Physical examinations included detailed history and records of height, weight, temperature, blood pressure, respiratory rate, and pulse rate immediately after exercise and 30 and 60 seconds thereafter. Evaluations were made of genitourinary, gastrointestinal, cardiorespiratory, and nervous sytems. Lab tests included routine urinalysis with qualitative and quantitative urobilinogen determinations (when indicated), complete blood count, sedimentation rate, blood urea nitrogen, glucose, bilirubin and thymel turbidity tests. All subjects remained well during the course of the experiment. All laboratory findings were negative (Fisher and Rosner 1959).

Dermal effects of B. t. were tested by application to shaved flanks and bellies of albino rabbits. Dosages ranged from 20 percent suspensions to 50 mg/animal. After application, half of the treated skin was abraded while the other half was left intact. Readings were made at 24, 48, and 72 hours in one test and up to 3 weeks in another. Other than local, mild erythema (abnormal redness

of the skin), no ill effects were noted in any test animal (Fisher and Rosner 1959; Corlett 1961). In another study, dermal application to albino rabbits was made to test allergenicity response. Ten sensitizing doses were applied every other day for 3 weeks. Readings were made 24 hours after each application of B. t. Two weeks after the 10th application, a challenge dose was applied. Only slight erythema and edema were noted. No allergenic response was elicited (Fisher and Rosner 1959). Allergenicity also was tested with guinea pigs following the procedure of Draize. No allergenic response was noted (Fisher and Rosner 1959).

Several acute toxicity tests were conducted on fish. A 4-day toxicity study was conducted with B. t. on rainbow trout and bluegills. Two groups of 10 fish each were placed in water containing B. t. at concentrations of 560 and 1,000 ppm. None of the trout or bluegills died (Fisher and Rosner 1959). Rainbow trout that were 4 inches long were exposed to B. t. at concentrations of 100 to 1,000 ppm for 14 days. No deaths resulted, nor were there symptoms of alimentary or behavioral disturbances evident (Fisher and Rosner 1959). In a test with juvenile coho salmon (1.6 inches long), B. t. was about 1/30 as toxic as DDT. The tests ran for 168 hours with concentrations of 8 to 406 mg B. t. per liter of water. The 48-hour median tolerance limit of the B. t. was about 50 mg/liter (Fisher and Rosner 1959).

Inhalation studies of B. t. were conducted on mice, rats, guinea pigs, and human volunteers. In one test with mice, the animals were exposed to 10 g of B. t. powder for 15 minutes. Dosages were applied 4 times over a period of 6 days. No ill effects were noted and gross pathology was negative (Fisher and Rosner 1959). In tests with rats and guinea pigs, exposure to a 10-percent B. t. preparation for 10 minutes produced no fatalities for the 1-week observation time. Dyspnea (discomfort) was noted, but recovery was rapid. The animals showed normal weight gain (Fisher and Rosner 1959). Five human volunteers inhaled 100 mg of B. t. powder daily for 5 days. Complete physical examinations before the test, immediately after the test, and 4 to 5 weeks later showed no abnormal conditions in the test subjects (Fisher and Rosner 1959).

Ocular irritation with B. t. was tested in albino rabbits. A dosage of 0.1 cc of a 20-percent suspension was instilled in each eye. One eye was

rinsed immediately with isotonic saline. Six animals were tested. The eyes were examined immediately, after 3 hours and 24 hours, and every 24 hours until they appeared normal. Slight redness of the eyelids was noted at 3 and 24 hours. Eye irritation disappeared in 48 hours (Fisher and Rosner 1959).

NPV is an extremely specific virus, affecting only members of the insect Family Lymantriidae. It has been shown to have no effects on other vertebrate or invertebrate organisms.

It is highly unlikely that the registered use of *B. t.* or NPV as applied during gypsy moth suppression or eradication projects would pose a human health hazard.

INTEGRATED PEST MANAGEMENT

An IPM strategy to gypsy moth management includes the integrated use of insecticides, parasite and predator management, the gypsy moth pheromone, release of sterile or partially sterile gypsy moth life stages, and forest stand manipulation. This approach provides a wider range of options in dealing with the gypsy moth problem by providing both short-term and long-term solutions; however, some of this technology still is in the developmental state.

Currently, only the biological and chemical insecticides are considered viable components for meeting the objectives of gypsy moth suppression projects. The use of forest stand manipulation, release of sterile or partially sterile gypsy moth life stages, and parasite or predator management need further field evaluation.

Eradication tools in addition to chemical pesticides are being developed. The unique nature of isolated infestations requires that eradication techniques be evaluated in this type of situation. This adds a degree of uncertainty in meeting eradication objectives since little efficacy data exists for some of the IPM components. Certain components have demonstrated population reduction potential, but several seasons may be necessary to achieve gypsy moth eradication objectives. *B. t.* was tested operationally in eradication projects for the first time in 1983 at 5 locations. This recent work was done with higher rates of *B. t.*

(16 BIU per acre per application) than have been used in the past, and with as many as 3 aerial applications. Results, although preliminary, are encouraging. Additional experience has been gained with the use of B. t. in conjunction with mass trapping techniques in a similar number of locations. Similar results were obtained.

The biological effects of an IPM approach will depend on the extent to which the various components are used. An IPM approach encourages the selection of insecticides or other components on the basis of actual needs and management objectives. The biological effects of the registered insecticides as used in an IPM approach have been discussed in the chemical and biological insecticide alternatives section.

Parasites and predators play an integral role in the overall gypsy moth management strategy in generally infested areas. Since it is neither economically or environmentally feasible nor desirable to treat the entire infested area with insecticides, parasites and predators are relied on to reduce gypsy moth populations in areas that are not treated. In the treatment-area selection process, areas that support parasite or predator populations sufficient to maintain gypsy moth populations below damaging levels are not identified for insecticide treatment. Treatment is considered only in those high-use and high-value areas where the threat of excessive larval nuisance and host defoliation is immediate, and where parasites, predators, and disease agents are not exerting effective biological pressure on gypsy moth populations.

Manipulation of parasite or predator populations to levels that would exert significant pressure on gypsy moth populations to reduce larval nuisance and host defoliation or mortality entails the timely release of large numbers of laboratory-reared specimens. Since the gypsy moth was introduced into the United States, extensive efforts have been directed to the introduction of parasites and predators. To date, approximately 50 species have been imported from Europe and Asia with limited degrees of success. The primary problem in the manipulation of parasites and predators is to establish and maintain populations at levels that will contribute to effective biological control.

Grimble (1976) studied the effects of the release of an established larval parasite, Apanteles melanoscelus (Ratz.) (Braconidae), and a pupal parasite, Brachymeria intermedia (Nees)(Chalcidae), on gypsy moth populations in New York. He concluded that the release of A. melanoscelus failed to increase the levels of parasitism by that species. The inundative release of B. intermedia did cause a significant increase in parasitism but only within a 30-chain (0.375 mile) distance of the release points.

In 1982, two new parasites from India were introduced in Delaware. They are A. flavicoxis and A. indiensis, parasites of the Indian gypsy moth. There is no indication that either of these parasites is established.

Between 1973 and 1979, 15 species of exotic parasites and predators from France, India, Spain, Yugoslavia, Japan, and Morocco were released in Pennsylvania to supplement existing populations of established parasites. Total project costs approached $1.5 million. By 1979, there was no evidence of any of these species becoming established. 3/

Since 1970, woodland study sites in New Jersey have been maintained to develop an understanding of gypsy moth population dynamics. During 1978, 402,047 parasites representing nine species were released in these sites. By 1979, a complex system of parasites appeared to be exerting biological pressures against the gypsy moth, one of the more significant parasites being Parasetigena silvestris (Robineau-Desvoidy). 4/

The gypsy moth sex pheromone, disparlure, has shown success in gypsy moth attraction and mating disruption strategies. The USDA and cooperating State agencies have successfully used disparlure-baited traps to delimit gypsy moth population boundaries and to identify isolated infestations. The attractive properties of disparlure make it an invaluable survey tool for locating predamaging gypsy moth populations.

3/ Robert A. Fusco, Pennsylvania Department of Environmental Resources, paper presented at Gypsy Moth Review, Columbus, Ohio, 1979.

4/ Letter from W.W. Metterhouse, N.J. Dep. Agric. to R.G. Doerner, NA, S&PF, USDA FS, dated July 30, 1979.

Disparlure is registered by the EPA. It is recommended for use only in low-level populations to reduce the incidence of gypsy moth mating. The reduction of mating will subsequently reduce the number of egg masses laid, which will help to maintain gypsy moth populations below damaging levels. The registered product, Hercon Luretape , is a disparlure-impregnated tape requiring manual application of forty 2-inch-square tapes per acre in a grid pattern. The registered application rate is 10 to 40 g active ingredient disparlure per acre. A second registered product by Hercon is a disparlure impregnated flake designed for aerial application at rates of 10 to 40 g/acre 5/.

The effectiveness of disparlure as a mating disruptant is density dependent. This means that the lower the level of infestation, the more effective the pheromone, the heavier the infestation, the less effective the pheromone. Therefore, the level of infestation must be determined before treatment to ensure the greatest mating disruption.

The use of disparlure to meet the objectives of foliage protection, larval nuisance reduction, and total population suppression requires further investigation. In low-level, isolated populations like those treated in APHIS/State eradication projects, disparlure baited, high-capacity traps, when set in dense arrays, show some potential for gypsy moth control; however, populations must be at extremely low levels. In heavy populations as proposed for treatment in suppression projects, disparlure alone is not effective.

Disparlure may prove feasible to further reduce populations that have been suppressed with insecticides or another component of an IPM program to meet suppression or eradication project objectives. The effects of disparlure also may occur in the 2nd year after application if the material successfully reduced population levels. These techniques need to be further developed.

The use of forest stand manipulation to suppress gypsy moth populations in high-value forest stands has been suggested in the past. However, this method has not proven biologically effective. In

---

5/ Letter from A. R. Quisumbing, Health-Chem Corporation to Noel F. Schneeberger, NA, S&PF, USDA FS, dated November 2, 1983.

suburban woodlands, stand manipulation is considered feasible to reduce gypsy moth impacts; less preferred hosts could be encouraged or even planted. Tree species that are less susceptible to gypsy moth defoliation include black walnut, white ash, catalpa, flowering dogwood, American holly, tulip-poplar, locust, sycamore, juniper, and balsam fir. In 1983, the USDA Forest Service initiated a research effort to study the use of silvicultural methods to control gypsy moth.

The release of large numbers of sterile or partially sterile male moths to reduce gypsy moth populations is a potential component of IPM. Research and development is continuing on the effectiveness of using sterile or partially sterile male moths to control gypsy moth populations. At the APHIS Otis Methods Development Laboratory, evaluations continue on refining male moth mass-rearing techniques and evaluating competitiveness of irradiated male moths.

A field test in which sterile male moths were used was performed in Michigan in 1980 and 1981. Monitoring of this site in 1982 and 1983 indicates that this infestation is now eradicated. APHIS will monitor this site for 1 more season before assessing final results. Development of the sterile and partially sterile male moth technique is targeted for use in isolated infestations outside of the Northeast where the technique might be useful in an eradication strategy. There is no threat of human sterility should persons come into contact with sterile or partially sterile gypsy moth adults. Implementation of chemical and biological insecticides in an IPM approach may result in physical effects similar to those described under the chemical insecticide and biological insecticide alternatives. Implementation of parasite and predator management, the gypsy moth pheromone, and release of sterile or partially sterile male moths will not cause any adverse impact on the soil, water, or air in the treatment areas.

Forest stand manipulation through harvesting and thinning methods could entail favoring less susceptible trees by removing preferred hosts or even by planting less favored hosts. Such activity might result in some soil erosion and silting of adjacent streams. Soil disturbances are temporary and often last no more than 2 or 3 months depending on the time of the year.

An IPM approach favors the increased use of alternative means of suppression over chemical insecticides and the use of those methods of suppression that create minimal impact on the environment while meeting project objectives.

PUBLIC NOTIFICATION AND INVOLVEMENT

In accordance with the NEPA process, the USDA encourages public involvement in the development of gypsy moth suppression and eradication projects. Public notification procedures relevant to these projects include:

- Providing public notice of scoping activities.

- Making EIS and related documents available to inform those agencies, groups, and individuals who may be interested in or affected by proposed actions. Copies of this Final EIS can be obtained by contacting Thomas N. Schenarts, USDA Forest Service or Robert L. Williamson, USDA APHIS. Addresses and phone numbers are listed on the first page of this document. Copies of past gypsy moth EIS's may also be obtained until available supplies are depleted. Thereafter, a fee will be assessed for making duplicate copies.

- Announcement of treatment dates to make it possible for anyone who has questions or concerns about adverse insecticide sensitivity to seek medical advice and adequate shelter that will avoid exposure during or after treatment or to leave the area to be treated until all danger of exposure has passed.

In addition, State and Federal agencies that cooperate with USDA and the Forest Service will actively seek public participation and involvement at the local level. The purpose of this public involvement process is to:

(1) Explain the proposed action and its need.

(2) Discuss the consequences (if any) of the proposed action.

(3) Solicit identification of local issues and concerns or individuals particularly sensitive to the insecticides planned for use so that appropriate mitigating measures can be developed.

(4) Stimulate discussion of alternative measures and their consequences.

(5) Guide the environmental analysis process. For gypsy moth suppression activities on private land, residents can opt out of the proposed project. Because of the objective of eradication projects, residents do not have the option of having their property deleted from the proposed treatments. As previously discussed, mitigating measures will be employed to minimize the concerns of those residents who are unable to opt out of eradication projects.

Specific public participation and notification procedures relative to individual gypsy moth suppression and eradication projects will be developed during site-specific environmental analyses, and conducted in accordance with NEPA.

LIST OF PREPARERS

Name: Noel F. Schneeberger

Position: Entomologist, USDA Forest Service, State and Private Forestry, Forest Pest Management, Morgantown, WV 26505.

Experience and Education: In current position since 1978. Previous assignment with USDA Forest Service was with the Application Group, Expanded Gypsy Moth Research, Development and Application Program, Hamden, CT. From 1976-1978 was Forest Pest Specialist with South Dakota Division of Forestry. Holds B.S. degree in Biology from Wittenberg University, Springfield, OH, and M.F. degree in Forest Entomology from Duke University, Durham, NC.

EIS Responsibility: Coordinated the environmental analysis for USDA Forest Service suppression projects. Coordinated development and compilation of the FEIS and Risk Analysis (Appendix F).

Name: Robert D. Wolfe

Position: Staff Pathologist, USDA Forest Service, State and Private Forestry, Forest Pest Management, Broomall, PA 19008.

Experience and Education: In present position since 1976. Nineteen years employment with the USDA Forest Service. Previous assignments were at Macon, GA, Alexandria, LA, and Asheville, NC. Holds a B.S. degree in Biology and a M.F. in Forest Pathology from Duke University, Durham, NC.

EIS Responsibility: Coordination of FEIS review, printing, distribution and filing with EPA. Major participation in environmental analysis for Forest Service suppression projects, and compilation of the FEIS. Coordinated Forest Service response to DEIS review comment letters. Participated in development of the Risk Analysis (Appendix F).

Name: Gary E. Moorehead

Position: Staff Officer, USDA APHIS, Plant Protection and Quarantine, Hyattsville, MD 20782.

Experience and Education: In current position since 1980. Twenty-three years service with APHIS, Plant Protection and Quarantine Program, sixteen of which involve Methods Development activities on biological control, IPM and gypsy moth. Holds a B.S. degree in Botany from Iowa State University and has done graduate work in Entomology at Purdue University.

EIS Responsibility: Coordinated environmental analysis for USDA APHIS, eradication projects and assisted in the compilation of the FEIS. Responsible for compiling APHIS response to DEIS review comment letters. Participated in development of the Risk Analysis (Appendix F).

Name: John Neisess

Position: Pesticide Specialist, USDA Forest Service, State and Private Forestry, Forest Pest Management, Washington, D.C.

Experience and Education: In current position since 1979. Responsible for pesticide impact assessment. Previously, research chemist with the USDA Forest Service, Pacific Northwest Forest Experiment Station, responsible for pesticide development, particularly microbials. Holds a Ph.D. in chemistry from Oregon State University.

EIS Responsibility: Major participant in development and compilation of the Risk Analysis (Appendix F). Developed Exposure Scenarios and reviewed toxicological information.

Name: William D. Rowe

Position: Director, American University Institute for Risk Analysis, Manager, Risk and Systems Analysis Group, PEER Consultants, Inc.

Experience and Education: B.A. Physics, Wesleyan University, Middletown, Connecticut. M.S. Physics, University of Pittsburgh. M.B.A., State University of New York. Ph.D., American University. Professional Registered Engineer. Manager Environmental Systems, Mitre Corporation 1968-1972. Deputy Assistant Administrator, EPA, 1972-1980. American University, 1979 to Present. PEER Consultant, 1983 to Present.

EIS Responsibility: Provided overall guidance during development and compilation of the Risk Analysis (Appendix F). Major participant in compilation of the Risk Analysis. Developed cancer and accident risk analysis.

INDEX

REFERENCES CITED

Abdalla, A. et al.
1965. Evaluation of an organophosphorus compound Dipterex, in the treatment of bilharzaisis. J. Egypt. Med. Assoc. 48:262-273.

Atherton, C.C.
1977. Legal requirements for environmental impact reporting, In handbook for environmental planning. J. McEvoy III and T. Dietz, Eds., John Wiley and Sons. New York.

Atkins, E.L., D. Kellum, and K.W. Atkins.
1981. Reducing pesticide hazards to honeybees. Division of Agriculture Science Leaflet 2883, University of California. Riverside.

Back, R. C.
1961. Memo summarizing Sevin residues on forest foliage. Union Carbide Corp.

Barrett, G.W.
1968. The effects of an acute insecticide stress on a semi-enclosed grassland ecosystem. Ecology. 49:1019.

Beaucher, W.N. and J.E. Farnham.
1982. Gypsy moth caterpillar dermatitis. New Engl. Journ. Med. 306:21 p. 1301-1302.

Beheyt, P. et al.
1961. A study of the toxicity to humans of an organophosphorus insecticide. Bull. W.H.O. 24:465-473.

Bess, H.A., S.H. Spurr, and E.W. Littlefield.
1947. Forest site conditions and the gypsy moth. Harvard Forest Bull. 22. 56 p.

Briggs, J.D. and R.C. Goodrich.
1959. Oral toxicity test for wild pheasants. Bioferm Int'l. Rep. 2 p. Unpubl.

Burdick, G.E., H.J. Dean, and E.J. Harris.
1960. Effects of Sevin upon the aquatic environment. N.Y. Fish and Game J. 7:14-25.

California Department of Fish and Game.
1963. An investigation into the effect on fish of Sevin (carbaryl) used in rice culture. PR Proj. W-52-R, Wildl. Invest. Lab., Resour. Agency, Calif. Dept. Fish and Game. 5 p. Unpubl.

Campbell, R.W.
1979. Gypsy moth: Forest influence. USDA Forest Service Agric. Inf. Bull. 423.

Campbell, R. W. and H. T. Valentine.
1972. Tree condition and mortality following defoliation by the gypsy moth. USDA Forest Serv. Res. Paper NE-236. 331 p.

Caslick, J.W. and N.J. Cutright.
1973. Effects of Dylox on birds. In Environmental impact and efficacy of Dylox used for gypsy moth suppression in New York State. App. For. Res. Inst., N.Y. State Coll. For. Syracuse, N.Y. p. 77-91.

Caslick, J.W. and W.G. Smith.
1973. Effects of Dylox on white-footed mice. In environmental impact and efficacy of Dylox used for gypsy moth suppression in New York State. Appl. For. Res. Inst., N.Y. State Coll. For. Syracuse, N.Y. p. 67-75.

Chambers, R.E.
1972. Effects of Dylox on animals and birds. Appl. Forestry Res. Inst., N.Y. State Coll. For. Rep. No. 10:43-58.

Chemagro.
1968. Dylox for control of forest insects. Chemagro Corp., Kansas City, Mo. 26 p. Unpub.

Chemagro.
1971. Synopsis of the effects of Dylox on the environment 20 p. in the effects of Dylox on the environment. Vol. 1 Chemagro Corp., Res. and Dev. Dep. Kansas City, Mo. May 3, 1971. 452 p. Unpubl.

Chevron Chemical Co.
1973. Orthene insecticide--environmental impact report. Chevron Chem. Co., Richmond, CA 94894 24 p.

Chevron Chemical Co.
1975. Orthene, a new concept in insect control. Chevron Chem. Co., Richmond, CA Proj. 75238-13-2/75. 19 p.

Chevron Chemical Co.
1976. Orthene insecticide--technical information. Chevron Chem. Co., Richmond, CA 94804. 4 p.

Comer, S.W., D.C. Staiff, J.F. Armstrong, and H.R. Wolfe.
1975. Exposure of workers to carbaryl. Bull. Environ. Contam. Toxicol. 13:385-391.

Conner, P.F.
1960. A study of small mammals, birds, and other wildlife in an area sprayed with Sevin. N.Y. Fish and Game J. 7(1):26-32.

Corlett, G.R.
1961. Investigation of the effects of *Bacillus thuringiensis* Berliner on mammals. Univ. of Ottawa. Publ.

Courtemanch, D.L. and K.E. Gibbs.
1978. The effects of Sevin 4 Oil on lentic communities. In Environmental monitoring of cooperative spruce budworm control projects, Maine 1976 and 1977. Maine Dep. Conserv., Bur. For., Augusta. p. 141-150.

Davis, A. and D.R. Bailey.
1969. Metrifonate in urinary schistosomi. Bull. WHO 41:209-224.

Doane, C.C. and P.W. Schaefer.
1971. Aerial application of insecticides for control of the gypsy moth with studies of effects on non-target insects and birds. Conn. Agr. Exp. Sta. Bull. 724. 23 p.

Doane, C.C. and J.W. Hitchcock.
1964. Field tests with an aerial application of Bacillus thuringiensis. Conn. Agr. Exp. Sta. Bull. 665. 20 p.

Dolinger, P.M. and W.L. Fitch.
Undated. Environmental health evaluation of California restricted insecticides. Carbaryl Monogr. 1. Rep. prepared for Calif. Dep. Food and Agric. by Peter Dolinger Assoc., Menlow Park, CA. 152 p.

Dunlap, T.R.
1980. The Gypsy Moth: A Study in Science and Public Policy, Journ. of For. Hist., 24:3, 10p.

Edwards, J.G., and R.A. Fusco.
1981. Gypsy moth larva host plant screening and reproduction studies. Final Report to California Department of Food and Agriculture

Eisenbrand, G., O. Ungerer, and R. Preussmann.
1975. The reaction of nitrate with pesticides. II. Formation. Chemical properties and carcinogenic activity of the N-nitroso derivative of N-methyl-l-naphthyl carbamate (carbaryl). Food Cosmet. Toxicol. 13:365-367.

Elespuru, R.K. and W. Lijinsky.
1973. The formation of carcinogenic nitroso compounds from nitrite and some types of agricultural chemicals. Food Cosmet. Toxicol. 11(5):807-817.

Fairchild, H.E.
1970. Significant information on the use of Sevin 4 Oil for insect control. Union Carbide Corp. Undated folder of text and various reports.

Fishbein, L.
1978. Overview of potential mutagenic problems posed by some pesticides and their trace impurities. Environ. Health Perspectives Vo. 27, pp. 125-131.

Environmental Protection Agency.
1969. USDA summary of registered agricultural pesticide chemical uses. Vol. 3. U.S. GPO, Washington, DC.

Environmental Protection Agency.
1975. DDT--A review of scientific and economic aspects of the decision to ban its use as a pesticide. EPA Report No. EPA-540/1-7S-022. [Available from NTIS, U.S. Dept. of Commerce, Springfield, Virginia 22151]

Finger, T. and R. Werner.
1973. Impact of Dylox on aquatic vertebrates. In Environmental impact and efficacy of Dylox used for gypsy moth suppression in New York State. Appl. For. Res. Inst., N.Y. State Coll. For. Syracuse, N.Y. p. 53-65.

Fisher, R. and L. Rosner.
1959. Toxicology of the microbial insecticide, Thuricide. J. Agr. Food Chem. 7:686-688.

Forbush, E.H., and C.H. Fernald.
1896. The gypsy moth, Porthetria dispar (Linn.). Wright and Potter Printing Co., Boston, MA.

Galt, D.
1983. The potential impact of the gypsy moth, Lymantria dispar (L.) on agriculture, forestry, and urban areas of California. Special report Cooperative Extension and Giannini Foundation of Agricultural Economics, Univ. of CA, p. 181.

Gilpatrick, J.D., and J. Terrill.
1970. Control of the gypsy moth with trichlofon applied ULV by aircraft in New York State in 19667. J. of Econ. Entomol. 63:15-18.

Gramlich, F.J.
1979. Effects of Sevin on songbird brain cholinesterese. In Environment monitoring of cooperative spruce budworm control projects. MAINE Dep. Conserv., Bur. For., Augusta. p. 107-110.

Grimble, D.C.
1976. Parasite release to suppress gypsy moth and reduce defoliation. App. For. Res. Inst. State Univ. New York. Report No. 32. 26 p.

Grimble, D.G., D.C. Allen, and T. Nakatsugawa.
1970. Aerially applied carbaryl for the control of saddled prominent caterpillars, Heterocampa guttivitta (Walk.) Appl. For. Res. Inst., Syracuse Univ. 16 p.

Halpin, G. J.
1980. Report on Cape May County. New Jersey State Department of Health, Parental and Child Health Services 24 p.

Harry, J.B.
1977. A review of human exposure to Sevin, carbaryl insecticide with particular reference to the U.S.A. Union Carbide Corp. Agric. Prod. Div., Silinas, CA 38 p.

Haynes, H.L., J.A. Lambrech, and H.H. Moorefield.
1957. Insecticidal properties and characteristics of 1-napthyl N-methylcarbamate. Contrib. Boyce Thomps. Inst. 18:507.

Heimpel, A.M.
1971. Safety of insect pathogens (in man and vertebrates). In Microbial control of insects and mites. H. D. Burger and N. W. Hussey, eds. Academic Press, N. Y. p. 469-489.

House, W.P.
1960. Gypsy moth-white pine damage study. Final Report. USDA-ARS. Plant Pest Control Div. Eastern Region. 48 p. Unpubl.

Hulbert, P.J.
1978. Effects of Sevin, a spruce budworm insecticide on fish and invertebrates in the Mattawamkeag River in 1976. In Environmental monitoring of cooperative spruce budworm control projects, Maine 1976 and 1977. Maine Dep. Conserv., Bur. For., Augusta. p. 1-32.

IBT.
1970a. Four-day fish toxicity study of Bacillus thuringiensis. Report to Abbott Laboratories IBT #A8275. Industrial Bio-test Laboratories, Inc. Mag 1970. 15 p. Unpubl.

IBT.
1970b. Acute oral toxicity study of Bacillus thuringiensis lot #842-3674 in bobwhite quail. Report to Abbott Laboratories IBT #J8276. Industrial Bio-test Laboratories, Inc. Oct. 20, 1972. 29 p. Unpubl.

IMC.
1969. Thuricide fact sheet. Int'l. Minerals and Chem. Corp. 20 p.

Innes, J.R.M., B.M. Ulland, M.G. Valerio, L. Petrucelli, L. Fishbein, E.R. Hart, A.J. Pallotta, R.R. Bates, H.L. Falk, J.J. Gart, M. Klein, I. Mitchell, and J. Peters.
1969. Bioassay of pesticides and industrial chemicals for tumorigenicity in mice: A preliminary note. J. Natl. Cancer Inst. 42:1101-1114.

Jaycox, E.R.
1963. Confinement of honey bee colonies to avoid pesticide losses. Journal of Agriculture Research 2; pp 43-49.

Johansen, C.
1959. Bee poisoning--a hazard of applying agricultural chemicals. Wash. Agr. Exp. Sta. Circ. 356. 5 p.

Judd, J.H., T.G. Coffey, and H.H. Willcox, III.
1972. Impact of Dylox on the aquatic environment. Appl. For. Res. Inst., N. Y. State Coll. For Rep. No. 10:59-77.

Karinen, J.F., J.G. Lamberton, N.E. Stewart, and L.C. Terriere.
1967. Persistence of carbaryl in the marine estuarine environment. Chemical and biological stability in aquarium systems. J. Agr. Food Chem. 15(1):148-156.

Karpel, M.
1973. Effects of trichlorfon and carbaryl on gypsy moth, elm spanworm, and related insect populations in Pound Ridge, N. Y. J. Econ. Entomol. 66(1):271-272.

Kegg, J.D.
1972a. Oak mortality on the rise. N. J. Forest Pest Reporter. VII (4), 2 p.

Kegg, J.D.
1972b. The impact of gypsy moth on woodlands. Eighth Northeast Aerial Applicators Conference. Cornell Univ., Ithaca, N. Y. March 21-23, 1972. pp. 71-79

Kirkland, A.H.
1905. The gypsy moth and brown tail moths. Wright and Potter Print. Co., Boston, MA.

Kondakov, Yu. P.
1963. Protecting Siberian forests from insect pests. Akad. Nak SSSR: Moscow 30-77. 1963. From: Referat. Zhur. BIOL 1964, No. 2E208 (Translation)

Kulman. H.M.
1971. Effects of insect defoliation on growth and mortality of trees. Ann. Rev. Entomol. 16:289-324.

Lake Ontario Environmental Laboratory (LOTEL).
1975. Environmental impact study of aerially applied Orthene on a forest and aquatic ecosystem. Lake Ontario Envir. Lab. State Univ. Coll., Oswego, N. Y. 226 p.

Lake Ontario Environmental Laboratory (LOTEL).
1977. The environmental impact of Sevin 4 Oil (carbaryl) on a forest and aquatic ecosystem. SUNY Lake Ontario Environ. Lab., Oswego. LOTEL Rep. 215. 128 p.

Leary, J.B., and H.O. Tutass.
1968. Degradation of Monitor insecticide in Soil. Chevron Chem. Co., Richmond, CA. 1 p.

Lewallen, L.L. and W.H. Wilder.
1962. Toxicity of certain organophosphorus and carbamate insecticides to rainbow trout. Mosquito News. 22:368-372.

Lewis, F.B., M.L. McManus, and N.F. Schneeberger.
1979. Guidelines for the use of GYPCHEK to control the gypsy moth. USDA For. Serv. Res. Pap. NE-441, 9 p., illus.

Lichenstein, E.P., K.R. Schulz, R.F. Skrentny, and Y. Tsukano.
1966. Toxicity and fate of insecticide residues in water. Arch. Env. Health. 12:199.

Lijinsky, William and H. Wayne Taylor.
1976. The effect of substituents on the carcinogenicity of N-nitrospyrrolidine in Sprague-Dawley rats. Cancer Res. 36(6): 1988-1990.

Marancik, J.
1976. Effect of insecticides used for spruce budworm control in 1975 on fish. In 1975 cooperative pilot control project of Dylox, Matacil, and Sumithion for spruce budworm control in Maine. USDA For. Serv. Northeast. Area, State and Priv. For., For. Insect Dis. Manage., Upper Darby, PA. August 1976. p. 11-34.

Marston, L.V., and V.M. Voronina.
1976. Experimental study of the effect of a series of phosphoroorganic pesticides (Dipterex and Imidan) on embryogeneis. Environ. Health Perspect. 13:121-125.

McCullough, R.D., and J.G. Stanley.
1980. Effects of carbaryl (Sevin) on brook trout in streams receiving drift from spraying of nearby forests. Maine Coop. Fish. Res. Unit, Univ. ME., Orono. 35 p.

Meister, R.T.
1983. Farm Chemicals Handbook. Meister Publishing Co., Willoughby, OH.

Minott, C.W. and I.T. Guild.
1925. Some results of the defoliation of trees. J. Econ. Entomol. 18:345-348.

Mirkovic, D. and V. Miscevic.
1960. Influence of the browse of gypsy moth (Lymantria dispar L.) upon the accretion of the oak-trees. Plant Protection (Zashtita Bilja) 60:3-19.

Miura, T., and R.M. Takahashi.
1975. Effects of the IGR, TH-6040, on non-target organisms when utilized as a mosquito control agent. Mosquito News. 35:154.

Moulding, J.D.
1972. The impact on forest bird and non-target arthropod populations of the use of the insecticide Sevin for gypsy moth control. Rutgers Univ. Ph.D. Thesis 102 p. Unpub.

Mulla, M.S., G. Majori, and H.A. Darwazeh.
1975. Effects of the insect growth regulator Dimilin or TH-6040 on mosquitos and some non-target organisms. Mosquito News. 35:211.

New Jersey Department of Environmental Protection.
1982. Economic impact of the gypsy moth. Division of Parks and Forestry, Bureau of Forest Management. Unpublished report, 7p.

New Jersey Epidemiologic Studies Program-Pesticides.
1974. Long-term clinical and biochemical study of an occupationally-exposed population. NJ State Dept. Health. 93 pp.

Ott, T., and I.B. Wilder.
1980. Effects of 1980 forest spraying on brook trout Univ. Maine, Orono, Coop. Fish Res. Unit. 5 p. (Unpubl. progress report submitted to Maine Bureau of Forestry).

Pack, D.E.
1972. Orthene occupational exposure--pilot plant formulations. Chevron Chem. Co., Richmond, CA 94804 62 p.

Pearce, P.A.
1970. Summary of Canadian Wildlife Service supported projects--

Pennsylvania Department of Environmental Resources.
1973. Status of gypsy moth. Pages 1-3 in 1973 annual report of operations and forest pest conditions. Penna. Dep. Env. Resources, Div. Forest Pest Management. 15 p. Unpub.

Pennsylvania Department of Environmental Resources.
1980. Annual Report Bureau of Forestry, Resources Management. Commonwealth of Pennsylvania.

Pillow, B.
1973. Pesticide field appraisal: gypsy moth suppression project. Special Report. USDI Fish and Wildl. Serv., Boston, MA Jan. 11, 1973. 13 p. Unpub.

Pintar, L.J., S. Burton, and G.M. Booth.
1975. Soil enrichment, isolation, identification of isolates, and toxicity studies of technical TH-6040 and DIMILIN W-25 on bacteria. Thompson-Hayward Chem. Co., Kansas City, Kan. 66110. File No. EC-22.

Richmond, M.L., C.J. Henny, R.L. Floyd, R.W. Marnan. D.M. Finch, and L.R. DeWeese.
1979. Effects of Sevin-4-Oil, Dimilin and Orthene on forest birds in Northeastern Oregon. Pacific Southwest Forest and Range Exp. Stn. Res. Pap. PSW-148. 19 p.

Rickard, R.W., and H. Wyman Dorough.
1979. Formation and fate of nitrosamides in animals. Toxicology and Applied Pharmacology. Vol. 48, No. 1, Part 2. Abstract 275:A138.

Romine, R.R., and R.A. Bussian.
1971. The degradation of carbaryl after surface application to a farm pond. Union Carbide Proj. Rep. 111A13. 5 p. Unpub.

Saleh, S.M.
1969. Fate of Bacillus thuringiensis in soil. Univ. of Wis. Ph.D. Diss. 96 p.

Schulze, T.L.
1979. Assessment of human exposure to carbaryl during aerial application for gypsy moth control in New Jersey. Unpub. report submitted to EPA, April 11, 1979.

Shama, S.K., P.H. Etkind, T.M. O'Dell, A.T. Canada, A.M. Finn, and N.A. Soter
1982. Gypsy moth caterpillar dermatitis. New Engl. Jorun. Med. 306:21 p. 1300-1301.

Siebert, D., and G. Eisenbrand.
1974. Induction of mitotic gene conversion in Saccharomyces cerevisiae by N-nitrosated pesticides. Mutat. Res. 22(2): 121-126.

Skoog, F.E.
1971. Influence of simulated rain on residual activity of ultra-low-volume application of carbaryl and malathion against grasshoppers. J. Econ Entomol. 64(1):196-200.

Smalley, H.E., and J. M. Curtis, and F. L. Earl.
1968. Teratogenic action of carbaryl in beagle dogs. Toxicol. Appl. Pharmacol. 13:392-403.

South Carolina Epidemiologic Studies Center.
1978. Measure of exposure to the carbanate carbaryl: Maine carbaryl study, 1978. Draft 1978 Interim report, Medical University of South Carolina, March 1979.

South Carolina Epidemiologic Studies Center.
1979. Measure of exposure to the carbanate carbaryl: Maine carbaryl study, 1979. Draft interim report, Medical University of South Carolina, November 1979.

Staples, R.E., R.G. Kellam, and J.K. Haseman.
1976. Developmental toxicity in the rat after ingestion or gavage of organophosphate pesticides (Dipterex, Imidan) during pregnancy. Environ. Health Perspect. 13:133-140.

Steelman, C.D., J.E. Farlow, T.P. Breaud, and P.E. Schilling.
1975. Effects of insect development inhibiting chemicals on Psorophora columbiae (Dyar and Knob) and non-target aquatic insect species in rice fields. Mosquito Nesw 35:67.

Stephens, G.R.
1971. The relation of insect defoliation to mortality in Connecticut forests. Conn. Agr.Exp. Sta. Bull. 723. 16 p.

Stephens, G.R. and D.E. Hill.
1971. Drainage, drought, defoliation, and death in unmanaged Connecticut forests. Conn. Agr. Exp. Sta. Bull. 718. 50 p.

Strang, G.E., J. Nowakoski, and R.A. Morse.
1968. Further observation on the effect of carbaryl on honey bees. J. Econ. Entomol. 64(1) 1103-1104.

Todaro, W. and J. Brezner.
1973. The effect of Dylox on aquatic insects. In Environmental impact and efficacy of Dylox used for gypsy moth suppression in New York State. Appl. For. Res. Inst., N.Y. State Coll. For. Syracuse, N.Y. p. 37-51.

Tompkins, W.A.
1966. Sevin residues in marine and fresh water aquatic organisms. In Report of the surveillance program conducted in connection with an application of carbaryl (Sevin) for the control of gypsy moth on Cape Cod, Mass. Common. of Mass. Pestic. board Pub. 547, p. 37-46.

Trial, J.G.
1978. The effects of Sevin 4 Oil on aquatic insect communities of streams: A continuation of 1976 studies. In Environmental monitoring of cooperative spruce budworm control projects, Maine 1976 and 1977. Maine Dep. Conserv., Bur. For., Augusta. p. 124-140.

Trial, J.G.
1979. The effects of Sevin 4 Oil on aquatic insect communities of streams (1976-1978). In Environmental monitoring of cooperative spruce budworm control projects, Maine 1978. Maine Dep. Conserv., Bur. For., Augusta. p. 6-22.

Tucker, B. V.
1972. Comparison of Orthene soil metabolism under aerobic and anaerobic conditions. Chevron Chem. Co., Richmond, CA 7 p.

Turner, N.
1963. The gypsy moth problem. Conn. Agr. Exp. Sta. Bull. 655. 36 p.

Tutass, H.O.
1968. Metabolism of monitor insecticide by plants. Chevron Chem. Co., Richmond, CA. 24 p.

Uchiyama N., M. Takeda, T. Suzuki, and K. Yoshikawa.
1975. Mutagenicity of nitrosoderivatives of N-methylcarbamate insecticides in microbiological method. Bull. Environ. Contam. Toxicol. 14:373-394.

Union Carbide.
1968. Technical information on Sevin carbaryl insecticide. Union Carbide Corp. IOG-0449A Booklet, 56. p.

Union Carbide.
1969. Toxicity of carbaryl metabolites. In Sec. C., Part IV, Pesticide Petition OF0902, Union Carbide Corp. to FDA, HEW, dated Oct. 28, 1969. 1 p. Unpubl.

U.S. Department of Agriculture.
1964. The effects of the 1964 gypsy moth treatment program in Pennsylvania and New Jersey on the total environment. USDA-ARS, Moorestown, N.J. Unpubl. 125 p.

U.S. Department of Agriculture.
1968. Suggested guide for the use of insecticides to control insects affecting crops, livestock, households, forest, and forest pests. Agr. Hnbk. 331, ARS and FS, USDA. 272 p.

U.S. Department of Agriculture.
1975. Forest insect and disease management evaluation report. Evaluation of Dimilin against the gypsy moth and effect on non-target organisms. U.S. Dep. Agric. For. Serv., Northeast. Area State and Priv. For., Upper Darby, PA.

U.S. Department of Agriculture.
1981a. The Gypsy Moth: Research toward integrated pest management. USDA For. Ser. and Science and Education Agency Tech. Bull. 1584. 757 p.

U.S. Department of Agriculture.
1981b. Effects of Gypsy Moth in calendar year 1980. USDA APHIS and For. Ser. Report to Congress.________1981.

U.S. Department of Agriculture.
1982a. Effects of Gypsy Moth in calendar year 1981. USDA APHIS and For. Ser. Report to Congress. February 25, 1982.

U.S. Department of Agriculture.
1982b. An economic and operational analysis of the APHIS gysy moth program. USDA APHIS PPQ, Hyattsville, MD. September 1982.

U.S. Department of Agriculture.
1983. Gypsy moth defoliation and its effect on commercial forests in 1982. USDA APHIS and For. Ser. Report to Congress, July 1983.

Wegner, D.
1970. Bilarcil (R) (Bay 2349) clinical trials 1960-1969. Farbenfabriken Bayer Pharm. Rept. 225. 23 p. Unpub.

Weiss, C., T. Nakatsugawa, J.B. Simeone, and J. Brezner.
1973. Gas chromatographic analysis of spray residues in a forest environment after aerial spraying of Dylox. In Environmental impact and efficacy of Dylox used for gypsy moth suppression in New York State. Appl. For. Res. Inst., N.Y. State Coll. Forestry, Syracuse, N.Y., p. 15-25.

Wells, L.F., Jr.
1966. Disappearance of carbaryl (Sevin from oak foliage in plots aerially sprayed for control of gypsy moth on Cape Cod, Mass, in 1965. Pages 12-17 in Report of the surveillance program conducted in connection with an application of carbaryl (Sevin) for the control of gypsy moth on Cape Cod, Mass. Commonwealth of Mass. Pesticide Board Pub. 547. 75 p.

Willcox, H.H. III.
1972. Progress Report of December 7. Environmental impact study of aerially applied Sevin 4 Oil on a forest and aquatic ecosystem. Lake Ontario Env. Lab. Oswego, N.Y. 55 p. Unpub.

Willcox, H.H. III.
1973. An evaluation of the environmental impact of aerial application of Orthene to the forest ecosystem. Progress Report. Lake Ontario Env. Lab., Oswego, N. Y. 39 p. Unpubl.

Willcox, H.H. III, and Thomas Coffey, Jr.
1977. Environmental effects of acephate (Orthene (R)) insecticide. U.S. Dept. Agric. For. Serv., Northeast. Area State and Priv. For., Broomall, PA. 18 p.

Willcox, H.H. III, and Thomas Coffey, Jr.
1978. Environmental impacts of diflubenzuron (Dimilin (R)) insecticide. U.S. Dept. Agric. For. Serv. Northeast. Area State and Priv. For., Broomall, PA, 18 p.

Wills, J.H., E. Janeson, and F. Coulston.
1969. Effects of oral doses of carbaryl on man. Clin. Toxicol. I (3): 265-271.

Zinkl, J.G., C.J. Henny, and L.R. DeWeese.
1977. Brain cholinesterase activities of birds from forests sprayed with trichlorfon (Dylox) and carbaryl (Sevin 4 Oil). Bull. Environ. Contam. Toxicol. 17:379-386.

Zinkl, J.G., C.J. Henny, and P.J. Shea.
1979. Brain cholinesterase activities of passerine birds in forests sprayed with cholinesterase inhibiting insecticides. In animals as monitors of environmental pollutants. Nat. Academy Sci., Wash., D. C. p.356-365.

Zinkl, J.G., R.B. Roberts, C.J. Henny, and D.J. Lenhart. 1980. Inhibition of brain cholinesterase activity in forest birds in squirrels exposed to aerially applied acephate. Bull. Environ. Contam. Toxicol. 24:676-683.

GLOSSARY

Acephate
: Organophosphate insecticide; the active ingredient found in insecticide formulations sold under the trade name Orthene®.

Acetylcholine
: A compound that is released at many automatic nerve endings. It is believed to function in the transmission of the nerve impulse.

Acetylcholinesterase
: An enzyme released at nerve endings in order to accelerate hydrolysis of acetylcholine thereby ending nerve stimulation after an impulse has passed.

Active ingredient (AI)
: The effective part of a pesticide formulation, or the actual amount of the technical material present in the formulation.

Acute toxicity
: The toxicity of a compound when given in a single dose or in multiple doses over a period of 24 hours or less.

AI
: Abbreviation for active ingredient.

APHIS
: Animal and Plant Health Inspection Service. The USDA agency responsible for regulating materials which have potential for artificially moving gypsy moth out of quarantined areas and for eradicating isolated infestations of gypsy moth.

Apiary
: A place where bees are kept. Bee hives.

Arthropods
: Major group of invertebrate animals belonging to the phylum Arthropoda. This group includes insects, spiders and crustaceans.

Artificial spread
: Term used to described the spread of gypsy by other than natural means; e.g. hitch-hiking insect stages on recreational vehicles, campers, cars, nursery stock, household goods, etc..

Bacillus thuringiensis
: Scientific name of a bacterium that is pathogenic to the larval stage of many lepidopterous insects. The active ingredient in biological insecticides sold under such names as Dipel®, Bactospeine®, and Thuricide®.

B. t.
: Abbreviation for *Bacillus thuringiensis*.

Buffer zones or areas
Usually set around sensitive areas such as lakes, streams or ponds that are not directly treated with insecticides; or areas set around the same, including people who object to chemical insecticides, that are treated instead with microbial insecticides such as *B. t.* or gypsy moth NPV. In some cases, may refer to areas actually treated, such as treatment of buffer zones along roads.

Caddisfly
A small moth-like insect. The larvae live in fresh water in portable cases they construct around themselves. Member of order Trichoptera.

Carbaryl
Carbamate insecticide; the active ingredient in insecticide formulations sold under the tradename Sevin®.

Carcinogenicity
Tendency of a substance to cause cancer.

Chitin
A semi-transparent horny substance forming the principal component of crustacean shells, insect exoskeletons and the cell walls of certain fungi.

Chitinase
An enzyme that hydrolyzes chitin.

Cholinesterase
See acetylcholinesterase.

Chronic toxicity
The effect of a compound on test animals when exposed to sublethal amounts continually. Usually daily exposures over a period of time: weeks, months or years.

Collembola
Springtails. Primitive, wingless group of insects commonly found in soil and duff.

Copepods
Usually, minute freshwater and marine crustaceans belonging to the order Copepoda.

Corixids
Group of aquatic insects, usually freshwater, that feed on algae and other minute aquatic organisms; belong to the family Corixidae.

Crustaceans
Large group of mostly aquatic arthropods belonging to the class crustacea and characterized by a chitinous or calcareous and chitinous exoskeleton. Members of this group include Copepods, water fleas, shrimps and wood lice, among others.

Cyclops
: Scientific name (genus) of a group of Copepods.

DEIS
: Draft Environmental Impact Statement

Diflubenzuron
: The active ingredient of insecticide formulations sold under the trade name Dimilin . Acts as a growth regulator by interfering with chitin synthesis and prevents gypsy moth from successfully completing their molting phases.

Dimilin W-25®
: Commercial wettable powder formulation of diflubenzuron registered for use against gypsy moth.

Dipel®
: Trade name of biological insecticide formulations containing the bacterium Bacillus thuringiensis.

Disparlure
: Commercially synthesized female gypsy moth sex pheromone. Disparlure is used to disrupt mating by making it difficult for male moths to locate female moths.

Dosage rate
: Quantity of a toxicant applied per unit area. Usually expressed as oz. or lbs. active ingredient per acre.

Dylox®
: Trade name of chemical insecticide formulations containing the active ingredient trichlorfon.

EC_{50}
: Median effective concentration; it is the concentration (ppm or ppb) of the toxicant in the environment (usually water) which produces a designated effect to 50 percent of the test organisms exposed.

EIS
: Environmental Impact Statement.

Environmental analysis
: Procedure defined by the National Environmental Policy Act of 1969 whereby the environmental impacts of a planned action (in this case gypsy moth suppression and eradication projects) are objectively reviewed.

EPA
: U.S. Environmental Protection Agency.

Eradication projects
: Projects whose objective is to eliminate gypsy moth infestations which were started as a result of artificial movement of gypsy moth life stages from generally infested areas.

Exclusion areas
Areas where product label prohibits the use of an insecticide, or areas identified during public involvement process as no-treatment areas.

FEIS
Final Environmental Impact Statement

Foliage protection
Tree foliage is considered to be prtected if the amount of defoliation that occurs is not severe enough to cause the tree to refoliate or produce a new set of leaves. Generally one of the major objectives in suppression projects.

Formulation
The form in which a pesticide is packaged or prepared for use.

Frass
Insect solid excrement.

FS
Forest Service. The USDA agency responsible for gypsy moth suppression projects.

Generally infested area or areas
That area, from Maine to northern Virginia and eastern West Virginia in which the gypsy moth is considered to be permanently established. Also includes an area in central Michigan in which gypsy moth is permanently established and where APHIS is no longer persuing eradication activities.

Gypchek®
USDA laboratory prepared and refined gypsy moth NPV product. Used as a biological insecticide.

Half-life
The time required for half the amount of substance (such as an insecticide) in or introduced into a living system to be eliminated whether by excretion, metablic decomposition, or other natural process.

Hemiptera
True bugs. Group of insects with semi-toughened forewings and sucking mouth parts.

Hymenoptera
A large order of insects comprised of the ants, bees, sawflies and wasps. The typical adult each have four membranous wings and chewing type mouthparts.

Instar
The term for a insect before each of the molts (shedding of its skin) it must go through in order to increase in size. Upon hatching from its egg, the insect is in instar I and is so called until it molts, when it begins instar II, etc.

Invertebrate

Major group of animals of which arthropods are members; characterized by the lack of backbone and spinal column.

IPM

Integrated Pest Management.

Isolated or remote infestation

As pertains to gypsy moth, any infestation(s) occurring outside of generally infested area resulting from artificial spreadof insect life stages, as opposed to natural spread of the insect. Once established, isolated infestations may spread or expand naturally if they are not eradicated.

Larva (plural larvae)

An insect in the earliest stage of development, after it has hatched and before it changes into pupa; a caterpillar, maggot, or grub.

LC_{50}

Median lethal concentration as the concentration (ppm or ppb) of a toxicant in the environment (usually water) which kills 50 percent of the test organisms exposed.

LD_{50}

Median lethal dose, is the milligram of toxicant per kilogram of body weight (mg/kg) lethal to 50 percent of the test animals to which it is administered under the conditions of the experiment.

Lepidoptera

A large order of insects, including the butterflies and moths; characterized by four scale-covered wings and coiled sucking mouthparts.

mg/kg/day

Milligrams per kilogram of body weight per day.

mg/kg

Milligrams per kilogram; used to designate the amount of toxicant required per kilogram of body weight of test organisms to produce a designated effect; usually the amount necessary to kill 50 percent of the test animals. One mg/kg = 1 ppm. One mg = 0.000035 ounce, and 1 kg = 2.2 pounds.

Mutagenicity

The capacity of a substance to cause changes in genetic material.

Natural spread

Opposite of artificial spread; spread of gypsy moth through natural means, for example young larvae carried on the wind or older larvae walking to new food sources. Natural spread of gypsy moth occurs from generally infested areas, or from permanently established isolated infestations.

NEPA
National Environmental Policy Act of 1969, Public Law 91-190.

Notonectids
Group of predaceous aquatic insects belonging to the family Notonectidae. Commonly called backswimmers.

NPV
Nucleopolyhedrosis virus. In this case, naturally occurring virus specific to gypsy moth, and common in heavy gypsy moth populations. The active ingredient in the biological insecticide Gypchek.

Orthene®
Commercially produced chemical insecticide formulation containing the active ingredient acephate.

Parasite
Any animal that lives in, on, or at the expense of another.

Pheromone
As pertains to gypsy moth, chemical produced and emitted by female moths to attract male moths for mating.

Phytotoxic
Poisonous or harmful to plants.

Plecoptera
Stoneflies. Group of insects, the nymphs of which are aquatic and mostly phytophagous.

Ppb
Parts per billion; the number of parts of a substance in question per billion parts of a given material. One ppb = 1 ug/liter (water or air).

Ppm
Parts per million; the number of parts of a substance in question per million parts of a given material. (1 ounce of salt in 62,500 lbs of sugar). One ppm = 1 mg/kg (on a weight basis) = 1 mg/liter (water or air).

Predator
An animal that preys on others.

Pupa (plural pupae)
The immobile, transformation stage in the development of an insect that, as an adult, is completely different in its appearance compared to what it looked like when it hatched from its egg. Examples include beetles, flies, moths, and wasps.

Quarantine area(s)
See regulated area(s).

Refoliation
Term used to describe a new flush of leaves in mid-season. In gypsy moth projects, if a tree has to refoliate, then the objective of foliage protection was not achieved.

Regulated area(s)
Areas where gypsy moth is permanently established and reproducing, and from which APHIS regulates the movement of materials such as household goods, nursery stock, and other commodities in order to prevent artificial movement of gypsy moth life stages to infested areas of the United States.

Regulatory programs
As pertains to gypsy moth, APHIS programs designed to reduce artificial spread from regulated areas and to eradicate isolated infestations of gypsy moth.

Remote infestations
See isolated infestations.

RPAR
Rebuttable Presumption Against Registration. EPA process for reviewing and subsequently approving or withdrawing registration of pesticides.

Scoping Session or activities
As defined under the National Environmental Policy Act - an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This may include public meetings whereby significant issues are identified, or may simply be letters of inquiry to interested agencies, groups or individuals.

Sevin 4 Oil®
Commercial insecticide formulation containing the active ingredient carbaryl.

Sevin 80 S®, Sevin Sprayable , Sevin XLR
See Sevin 4 Oil.

Suppression projects
Projects administered by USDA Forest Service, in cooperation with State or Federal agencies, designed to relieve high gypsy moth populations in high-value high-use areas or to prevent tree mortality in forested areas. Also includes comparable projects on National Forest System lands.

Tachinidae
Family of flies, the larvae of which are parasitic.

Teratogenicity
The capacity of a substance to cause anatomical, physiological, or behavioral defects in animals exposed during embryonic development.

Thuricide®
: Commercial biological insecticide formulation containing the active ingredient *Bacillus thuringiensis*.

Trichlorfon
: Active ingredient found in chemical insecticide formulations sold under the tradename Dylox®.

USDA
: United States Department of Agriculture.

USDI
: United States Department of the Interior.

APPENDIX A

1983 SCOPING PROCESS: AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONTACTED

FOREST SERVICE

Director
Southeastern Forest Exp. Stn.
200 Weaver Boulevard
Asheville, NC 28804

Director
Southern Forest Experiment Stn.
U.S. Postal Service Bldg.
701 Loyola Avenue
New Orleans, LA 70113

APHIS

USDA, APHIS, PPQ
Regional Director - W
1 Hartford Square West
Building 1, Third Floor
Hartford, CT 06106

USDA, APHIS, PPQ
Area Director
Suite 503
80 Wolf Road
Albany, NY 12205

USDA, APHIS, PPQ
Area Director
Rural Route 6, Box 53
Wilmington, NC 28401

USDA, APHIS, PPQ
Area Director
William Green Federal Building
6th & Arch Streets, Room 9452
Philadelphia, PA 19106

USDA, APHIS, PPQ
Regional Director - NE
505 S. Lenola Road
Morrestown, NJ 08507

USDA, APHIS, PPQ
Area Director
1010 Jorie Blvd., Suite 38
Oak Brook, IL 60521

USDA, APHIS, PPQ
Area Director
915 Southwest Blvd., Suite K-2
Jefferson City, MO 65101

USDA, APHIS, PPQ
Area Director
3505 25th Avenue
P. O. Box 13
Gulfport, MS 39501

USDA, APHIS, PPQ
Regional Director - SE
P.O. Box 3659
Gulfport, MS 39503

USDA, APHIS, PPQ
Area Director
Brownett Bldg.
4080 Woodcock Drive, Suite 129
Jacksonville, FL 32207

USDA, APHIS, PPQ
FAA and NWS Building
P.O. Box 59 - 2647 AMF
Miami, FL 33159

USDA, APHIS, PPQ
Area Director
727 East Durango
Federal Building, Room B-201
San Antonio, TX 78206

USDA, APHIS, PPQ
Area Director
200 E. Nopal Street, Suite 208
Uvalde, TX 78801

USDA, APHIS, PPQ
Area Director
Room 2315, Intl. Arrl. Bldg.
J.F. Kennedy Intl. Airport
Jamaica, NY 11430

USDA, APHIS, PPQ
Regional Director - SE
Suite 400
2100 BoCA Chica Blvd.
Brownsville, TX 78521

USDA, APHIS, PPQ
Area Director
Room 205, Towers Royale
520 Old Spanish Trail
Slidell, LA 70458

Regional Director - W
USDA, APHIS, PPQ
620 Central Avenue
Building 2B, Room 103
Alameda, CA 94501

USDA, APHIS, PPQ
Area Director
3112 Federal Building
Seattle, WA 98174

USDA, APHIS, PPQ
Area Director
7100 W. 44th Avenue, Suite 102
Wheat Ridge, CO 80033

APHIS - continued

USDA, APHIS, PPQ Area Director
1515 Clay Street, Room 450
Oakland, CA 94612

USDA, APHIS, PPQ
Area Director
522 N. Central Avenue, Room 201
Phoenix, AZ 85004

USDA, APHIS, PPQ
Area Director
40 S. Gay Street, Room 419
Baltimore, MD 21202

USDA, APHIS, PPQ
Area Director
P.O. Box 50002
Honolulu, HI 96850

USDA, APHIS, PPQ Area Director
26 Federal Plaza
Room 1747
New York, NY 11430

EPA

EIS Review Coordinator, R IV 14
Environmental Protection Agency
1421 Peachtree Street, NE
Atlanta, GA 30309

EIS Review Coordinator, R VI 14
Environmental Protection Agency
1600 Patterson Street
Dallas, TX 75201

NATIONAL PARK SERVICE

Mr. Robert M. Baker, Director
National Park Service
Southeast Regional Office
75 Spring Street, SW
Atlanta, GA 30303

OTHER FEDERAL AGENCIES

Mr. Stephen D. Bean, Forester
Wildland Management and Planning
Division of Forestry, Fisheries,
& Wildlife Development
Tennessee Valley Authority
Norris, TN 37828

Entomologist T H Lauret
Pacific Division
Naval Facilities Eng. Command
Pearl Harbor, HI 96860

USDA Government & Public Affairs
Office of Intergov. Affairs
Room 102 Adm. Bldg.
Washington, DC 20250

STATE FORESTRY AGENCIES

Mr. Robert L. Garrepy
State Forester
Dept. of Environ. Protection
State Office Building, Room 260
165 Capitol Avenue
Hartford, CT 06106

Mr. Walter F. Gabel
State Forester
Dept. of Agriculture
Forestry Section, Drawer D
Dover, DE 19903

Mr. Allan S. Mickelson
State Forester
Division of Forest Resources
& Natural Heritage
Department of Conservation
600 North Grand Avenue West
Springfield, IL 62707

Mr. John F. Datena
State Forester
Department of Natural Resources
Division of Forestry
State Office Building
Indianapolis, IN 46204

Mr. H. Gene Hertel
State Forester
Iowa State Conservation Comm.
Wallace State Office Building
Des Moines, Iowa 50319

Mr. Kenneth G. Stratton
Director
Bureau of Forestry
Department of Conservation
State House Station #22
Augusta, Maine 04333

Mr. Donald E. MacLauchlin, Dir.
MD Forest & Parks Service
Department of Natural Resources
Tawes State Office Bldg.
580 Taylor Avenue
Annapolis, MD 21401

Mr. Gilbert A. Bliss, Director
Division of Forest and Parks
Department of Environmental Mgt.
100 Cambridge Street
Boston, MA 02202

STATE FORESTRY AGENCIES - continued

Dr. Henry H. Webster
State Forester
Department of Natural Resources
Stevens T. Mason Building
Box 30028
Lansing, MI 48909

Mr. Raymond B. Hitchcock
Director
Division of Forestry
Department of Natural Resources
Centennial Office Building
658 Cedar Street
St. Paul, MN 55155

Mr. Jerry J. Presley
State Forester
Forestry Division
MI Department of Conservation
2901 North 10-Mile Drive
Box 180
Jefferson City, Missouri 65102

Mr. Theodore Natti, Director
Division of Forests and Lands
Dept. of Resources & Economic Development
Box 856, 105 Loudon Road
Concord, NH 03301

Mr. George H. Pierson
State Forester
Division of Parks and Forestry
Department of Environmental Protection
Forestry Services, CN-404
Trenton, NJ 08625

Mr. Norman J. VanValkenburgh
Director
Division of Lands and Forests
NY State Dept. of Environmental Conservation
50 Wolf Road
Albany, NY 12233

Mr. David M. Bergman
Acting State Forester
Division of Forestry
Department of Natural Resources
Fountain Square
Columbus, OH 43224

STATE FORESTRY AGENCIES - continued

Mr. Richard R. Thorpe, Director
Bureau of Forestry, DER
100 Evangelical Press Building
P. O. Box 1467
Third and Reilly Streets
Harrisburg, PA 17120

Henry J. Deion, Jr.
State Forester
Division of Forest Environment
RFD #2, Box 851
North Scituate, RI 02857

Mr. E. Bradford Walker, Director
Division of Forests
Agency of Environmental Conser.
Montpelier, VT 05602

Mr. B. J. Warder
State Forester
Division of Forestry
State Office Building #3
1800 Washington Street, East
Charleston, WV 25305

Mr. Milton E. Reinke
Chief State Forester
Department of Natural Resources
101 S. Webster Street
P. O. Box 7921
Madison, Wisconsin 53707

Dr. Charles W. Puffinberger
Department of Agriculture
Office of Plant Industries & Pest Management
50 Harry S. Truman Parkway
Annapolis, MD 21401

Mr. John C. Dreves, Chief
Plant Industry Division
MI Department of Agriculture
Lewis Cass Building
P. O. Box 30017
Lansing, MI 48909

Mr. William Metterhouse
Director
Division of Plant Industry
Department of Agriculture
CN-330
Trenton, NJ 08625

STATE FORESTRY AGENCIES - continued

Mr. Albert E. Cole
Director
Division of Plant Pest Control
Department of Agriculture
State Capitol
Charleston, WV 25305

Cindy Rotz
Joint Conservation Committee
Box 254 Main Capitol
Harrisburg, PA 17113

Representative, Sierra Club
3300 Pennsylvania Avenue, SE
Washington, DC 20003

Director
Scientific Staff
Massachusetts Audubon Society
Lincoln, MA 01773

Jeff Robbins
Association of NJ Environmental Committee
P. O. Box 157
Mendham, NJ 07945

Izaak Walton League of America
1800 N. Kent Street - Suite 806
Arlington, VA 22209

Paul Finger
Thompkins County Environmental Management Council
128 East Buffalo Street
Ithica, NY 14850

Linda Jean Hiltbold
P.A.U.S.E.
130 Selma Blvd.
Randolph, NJ 07869

Robert H. Gardiner
Natural Resources Council of Maine
271 State Street
Augusta, ME 04333

Cheryl Ring
Maine Audubon Society
118 Route One
Falmouth, ME 04105

STATE FORESTRY AGENCIES - continued

Liz Rodrigues, Secretary
New Jersey Beekeepers Association, Inc.
157 Five Point Road
Colts Neck, NJ 07722

Sierra Club
Atlantic Chapter
800 Second Avenue
New York, NY 10017

Frank Zettle
Environmental Committee
Spring Creek Chapter T.U.
616 Sunselt Road
State College, PA 16801

Nancy Coleman
Parsippany Committee for Gypsy Moth
4 Crawford Road
Morris Plains, NJ 07950

Paul I. Twerdowsky
Highlands Watershed Association
1117 Macopin Road
W. Milford, NJ 07480

Project Manager
Appalachian Trail Project Off.
Harpers Ferry Center
Harpers Ferry, WV 25425

State Forester
Division of Forest Resources
P. O. Box 27687
Raleigh, NC 27611

Leonard A. Kilian, Jr.
SC Commission of Forestry
P. O. Box 21707
Columbia, SC 29221

Wallace F. Custard
Virginia Division of Forestry
P. O. Box 3758
Charlottesville, VA 22903

STATE FORESTRY AGENCIES - continued

Mr. John F. Anderson
Connecticut Agriculture
Experiment Station
123 Huntington Street
P. O. Box 11066
New Haven, CT 06504

Elizabeth S. Hendrick
Westchester County Health Dept.
Bureau of Environmental Quality
150 Grad Street
White Plains, NY 10601

C. L. Morris
Dept. of Conservation &
Econ. Development
Division of Forestry, Box 3758
Charlottesville, VA 22903

Alfred L. Hawkes, Executive Dir.
Audubon Society of Rhode Island
40 Bowen Street
Providence, RI 02903

Director
Pesticide Control Board
Department of Agriculture
Station 28, State House
Augusta, Maine 04333

Pat Miller
Citizen for Responsible
Action on Gypsy Moth
RFD Newfield Road
Waterboro, ME 04087

James T. Gaffney
Executive Director
Stony Brook-Millstone
R.D. 1, Box 263-A
Titusmill Road
Pennington, NJ 08524

C.W. Moody, State Forester
Alabama Forestry Commission
513 Madison Avenue
Montgomery, AL 36180

Michael P. Mety, State Forester
Arkansas Forestry Commission
P. O. Box 4523 Asher Station
Little Rock, AR 72214

STATE FORESTRY AGENCIES - continued

John M. Bethea, Director
Florida Div. of Forestry
Florida Dept. of Agriculture
and Consumer Services
3125 Conner Blvd.
Tallahassee, FL 32301

John Mixon, Director
Georgia Forestry Commission
P. O. Box 819
Macon, GA 31298-3237

Donald A. Hamm, Director
Kentucky Division of Forestry
627 Commanche Trail
Frankfort, KY 40601-1798

Donald L. McFatter
Assistant Secretary
Office of Forestry
Dept. of Natural Resources
P. O. Box 1628
Baton Rouge, LA 70821

H.J. (BOE) Green, Director
Division of Forest Resources
NC Dept. of Natural Resources
and Community Development
Box 27687
Raleigh, NC 27611

Roger L. Davis, Director
Forestry Division, Dept. of Agr.
122 State Capitol Bldg.
Oklahoma City, OK 73105

Leonard A. Kilian, Jr., SF
Commission of Forestry
P. O. Box 21707
Columbia, SC 29221

Roy C. Ashley, State Forester
Tennessee Division of Forestry
Department of Conservation
701 Broadway
Nashville, TN 37203

Bruce R. Miles, Director
Texas Forest Service
Systems Admn. Building
College Station, TX 77843

STATE FORESTRY AGENCIES - continued

James W. Garner, Jr.
State Forester
VA Division of Forestry
P. O. Box 3758
Charlottesville, VA 22903-0758

STATE CLEARINGHOUSES

Alabama Development Office
C/O State Capitol
Montgomery, AL 36130

Bureau of Intergovernmental Relations
Div. of State Planning
Dept. of Administration
660 Apalachee Parkway
Tallahassee, FL 32304

Office of Planning and Budget
Room 610
Control #GA81-07-10-006
270 Washington Street, SW
Atlanta, GA 30334

State Clearinghouse
Office for Policy and Management
209 Capitol Annex
Frankfort, KY 40601

Office of State Clearinghouse
Dept. of Urban and Comm. Affairs
Box 44455
Baton Rouge, LA 70804

State Clearinghouse
MS810707-006
1303 Sillers Bldg.
500 High Street
Jackson, MS 39202

State Clearinghouse
Division of Budget and Mgt.
Department of Administration
116 West Jones Street
Raleigh, NC 27611

Dept. of Econ. & Comm. Affairs
Lincoln Plaza Bldg., Suite 285
4545 North Lincoln Boulevard
Oklahoma City, OK 73105

State Clearinghouse
Grants and Contracts Review Unit
State Auditor
P. O. Box 11333
Columbia, SC 29211

STATE CLEARINGHOUSES - continued

Tennessee State Planning Office
1800 James K. Polk Office Bldg.
505 Deaderick Street
Nashville, TN 37219

Gov.'s Budget and Planning Office
P. O. Box 13561
Austin, TX 78701
ATTN: Darla Parker

VA Department of Intergovern. Affairs
Ninth Street Office Building
9th Floor, Room 916
Richmond, VA 23219

OTHER STATE AGENCIES

Judith Freeman, Ph.D.
Entomologist, Special Projects
State of Washington
Department of Agriculture
406 General Admin. Bldg., AX-41
Olympia, WA 98504

Asst. Dir. for Plant Industry
Dept. of Food and Agriculture
1220 N. Street
Sacramento, CA 95814

Plant & Pesticide Spec. Supvr.
IL Dept. Agr.
Div Agr. & Ind. Reg.
1010 Jorie Blvd., Suite 20
Oakbrook, IL 60521

Director
Arizona Comm. of Agr. & Hort.
1688 West Adams #414
Phoenix, AZ 85007

Dir, Div of Plant Industries
NV State Dept. of Agriculture
P. O. Box 11100
Reno, NV 89510

Chief, Excl. & Det.
Div. Plant Industry
CA Dept. Food and Agriculture
Sacramento, CA 95814

R. O. Barrett, Director
Division Plant Industry
NYS Dept. Agriculture & Markets
Building #8, State Campus
Albany, NY 12235

State Entomologist
Agricultural Experiment Station
P. O. Box 1106
New Haven, CT 06504

Director, Division of Entomology and Pesticides
GA Department of Agriculture
Room 304
Agricultural Bldg., Capital Sq.
Atlanta, GA 30334

Director
Agr. Chemical and Plant Industry
AL Department of Agriculture
and Industry
P. O. Box 3336
Montgomery, AL 36109

State Plant Pathologist
Delaware Dept. of Agriculture
Drawer D
Dover, DE 19903

Director, Div. Plant Industry
State Plant Board
P. O. Box 1069
Little Rock, AR 72203

Director, Div. of Plant Industry
Colorado Dept. of Agriculture
1525 Sherman Street
Denver, CO 80205

Director
Division of Plant Industry
FL Dept. of Agr. & Consumer
Service
P. O. Box 1269
Gainesville, FL 32602

Chief, Plant Quarantine Branch
Hawaii Dept. of Agriculture
701 Ilalo Street
Honolulu, HI 96813

State Entomologist
Division of Entomology
State Dept. Natural Resources
613 Indiana State Office Bldg.
Indianapolis, IN 46204

State Entomologist - J. Impson
Office of Agriculture &
Environmental Science
P. O. Box 44153
Capitol Station
Baton Rouge, LA 70804

Director, Div. of Plant Industry
Maine Dept. of Agriculture
State House Section 28
Augusta, ME 04333

OTHER STATE AGENCIES - continued

Dir., Plant Industry Division
Missouri Dept. of Agriculture
P. O. Box 630
Jefferson City, MO 65102

State Entomologist
Iowa Dept. of Agriculture
East 9th & Grand Wallace Bldg.
Des Moines, IA 50319

Director, Division of Entomology
KS State Board of Agriculture
109 SW 9th Street
Iopeka, KS 66612

Director
Div. of Plant Pest Control
MA Dept. of Food & Agriculture
100 Cambridge Street
Boston, MA 02202

Chief, Plant Industry Division
MI Dept. of Agriculture
P. O. Box 30017
Lansing, MI 48909

State Entomologist
Division of Plant Industry
MS Dept. of Agriculture
and Commerce
P. O. Box 5207
Mississippi State, MS 39762

Administrator
Division of Plant Industry
Idaho Dept. of Agriculture
P. O. Box 790
Boise, ID 83701

State Entomologist
Department of Entomology
Agricultural Experiment Station
S-225 Agricultural Sci. Center N
Lexington, KY 40546

Asst. Secretary, Office of Plant
Industry and Pest Management
MD Dept. of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401

Director, Div. of Plant Industry
MN Department of Agriculture
90 West Plato Blvd.
St. Paul, MN 55107

Administrator
Plant Industry, Div. Mt. Dept. A
Agriculture/Livestock Bldg.
Capitol Station
Helena, MT 59620

Plant Pest Administrator
Plant Protection
Plnt. Indus. Div
NC Dept. of Agriculture
P. O. Box 27647
Raleigh, NC 27611

State Entomologist
Insect & Plant Dis. Suprn. & Con.
c/o Entomology Department
Nesmith Hall
Durham, NH 03824

Chief, Division of Plant Industry
Ohio Department of Agriculture
Reynoldsburg, OH 43068

Dir., Bur Plant Industry
State Department of Agriculture
2301 North Cameron Street
Harrisburg, PA 17110

Plant Quarantine Office
Div. of Agriculture, Regulations
and Inspection
State Department of Agriculture
Anderson Building
Pierre, SD 57501

State Entomologist
ND Dept. of Agriculture
State Capital
Bismarck, ND 58505

Director
Div. of Plant Industry
NJ Department of Agriculture
CN-330
Trenton, NJ 08625

OTHER STATE AGENCIES - continued

Program Administrator
Plant Nursery and Seed
Plant Industry Division
OK Department of Agriculture
122 State Capitol Bldg.
Oklahoma City, OK 73105

Chief Entomologist
Division of Forest Environment
RI Dept. of Environmental Mgt.
RFD #2, Box 851
North Scituate, RI 02857

Director
Division of Plant Industry
TN Department of Agriculture
P.O. Box 40627, Melrose Station
Nashville, TN 37204

State Entomologist
Bur. Plant Industry
NE Department of Agriculture
P. O. Box 94755
Lincoln, NE 68509

Chief Bur
Entomology & Nursery, Inc.
NM Department of Agriculture
P. O. Box 3 BA
Las Cruces, NM 88003

Administrator
Plant Division
OR Department of Agriculture
Agricultural Bldg.
Salem, OR 97310

Head Plant Pest Regulation Ser.
RM. 218, Barre Hall
Clemson University
Clemson, SC 29631

Director
Agr. & Environmental Sciences
TX Department of Agriculture
P. O. Box 12847, Capital Stn.
Austin, TX 78711

State Entomologist
Bur. Plant Industry
UT Department of Agriculture
350 North Redwood Road
Salt Lake City, UT 84116

OTHER STATE AGENCIES - continued

Director
Division of Plant Industry
State Department of Agriculture
116 State Street
State Office Bldg.
Montpelier, VT 05602

Director
Plant Pest Control Division
WV Department of Agriculture
Charleston, WV 25305

State Supervisor
Plant Pest Division
Prod. & Industry Reg.
Department of Agriculture
P. O. Box 1163
Richmond, VA 23209

Assistant Director
WA State Depart. of Agriculture
Plant Industry Division
406 General Admin. Bldg. AX-41
Olympia, WA 98504

Agric. Plant Industry Manager
Consumr-Compl. Division
WY Department of Agriculture
2219 Carey Avenue
Cheyenne, WY 82002

Administrator
Plant Industry Division
WI Department of Agriculture
Trade and Cons. Protection
801 W Badger Road
Madison, WI 53713

PRIVATE ORGANIZATIONS

Alabama Environmental Quality Association
3815 Interstate Court
Suite 202
Montgomery, AL 31609

American Alliance for HPER
1201 16th Street, NW
Washington, DC 20036

Mr. G. Robert Kerr
The Georgia Conservancy
3110 Maple Drive, Suite 407
Atlanta, GA 30305

Mr. J.B. Jackson, Jr.
Administrator
Gov.'s Environmental Council
903 9th Street
Richmond, VA 32319

President
Ozark Society
P. O. Box 2914
Little Rock, Arkansas 72203

Mr. Bill Cole
The Nature Conservancy
415 Park Street
Charlottesville, VA 22901

Alabama Conservancy
1816 East 28th Avenue, South
Birmingham, Alabama 35209

Ms. Martha McKinney, Exec. Dir.
Appalachian Consortium, Inc.
202 Appalachian Street
Berne, NC 28707

Christine Luboff
W_2TC Regional Coordinator
Western Washington Toxics Coal.
4512 University Way N.E.
Seattle, WA 98105

Robert Ginsburg, Ph.D.
Staff Chemist Toxicologist
Research Director-IL/IN
Citizens for a Better Government
Suite 1600/59 East Van Buren St.
Chicago, IL 60605

PRIVATE ORGANIZATIONS - continued

G. M. Zemansky, Ph.D.
Friends of the Earth
Northwest Office
4512 University Way NE
Seattle, WA 98105

Charles M. Clusen
The Wilderness Society
1901 Pennsylvania Avenue, NW
Washington, DC 20036

Mr. Ed Clark, Jr., President
Virginia Wilderness Committee
P. O. Box 7
Flint Hill, VA 22627

American Forest Institute
1619 Massachusetts Avenue, NW
Washington, DC 20036

Mr. W.D. Page
American Plywood Association
1581 Phoenix Boulevard
Suite 6
Atlanta, GA 30340

Director, National Wildlife Fed.
1412 Sixteenth St., NW
Washington, DC 20036

Forest Farmers Association
P. O. Box 95385
4 Exec. Park East, NE
Atlanta, GA 30347

Lumber Manufacturing Association of Virginia
Mr. Randy Bush
220 E. Williamsburg Road, POB U
Sandston, VA 21350

George Kelly, Exec. Vice President
Southern Hardwood Lumber Manufacturing Association
805 Sterick Bldg.
Memphis, TN 38103

Ron Hufford
Southern Forest Products Assoc.
P. O. Box 52468
New Orleans, LA 70152

PRIVATE ORGANIZATIONS - continued

Appalachian Regional Commission
Robert W. Scott
1666 Connecticut Ave., NW
Washington, DC 20235

Potomac Appalachian Trail Club
1718 N Street, NW
Washington, DC 22036

Thomas Masingale
NC Nature Conservancy
P. O. Box 805
Chapel Hill, NC 27514

John H. Davis, Exec. Director
National Recreation & Parks Association
1601 N. Kent St.
Arlington, VA 22209

Gene Bergoffen
National Forest Products Association
1619 Massachusetts Avenue, NW
Washington, DC 20036

Conservation Foundation
1717 Massachusetts Ave., NE
Washington, DC 20036

Environmental Defense Fund
Mr. David W. Hoskins
447 Park Avenue South
New York, NY 10016

UNIVERSITY

Dr. Kent T. Adair, Dean
School of Forestry
Stephen F. Austin University
Nacogdoches, TX 75961

Dr. B.H. Box, Dean
College of Forest & Rec. Res.
Clemson University
Clemson, SC 29631

Dr. Emmett Thompson
Auburn University
Department of Forestry
Auburn, AL 36849

Dr. Benjamin A. Jayne, Dean
School of Forestry and
Environmental Studies
Duke University
Durham, NC 27706

Dr. G. A. Bradley
Dept. of Horticulture and For.
University of Arkansas
Fayetteville, AR 72701

Dean
School of Forest Resources
University of Georgia
Athens, GA 30602

Dr. Thomas Hansbourough
School of Forestry and
Wildlife Management
Louisiana State University
Baton Rouge, LA 70803

Dr. Bart Thielges
School of Forestry
University of Kentucky
Lexington, KY 40506

Dean
School of Forest Resources
Mississippi State University
Mississippi State, MS 39762

Dr. Eric Ellwood, Dean
School of Forestry
NC State University
Raleigh, NC 27607

UNIVERSITY - continued

Dr. Charles Lee
Dept. of Forest Science
Texas A&M University
College Station, TX 77843

Dr. J. F. Hosne
School of Forestry
VPI & State University
Blacksburg, VA 24061

Dr. G. G. Schneider
Department of Forestry
University of Tennessee
Knoxville, TN 37901

James E. Neal
205 Barrow Hall
University of Georgia
Athens, GA 30602

INDUSTRY

Steve Dianus
Weyerhaeuser Company
Rt. 3, Box 282
Washington, DC 27889

MISCELLANEOUS

David A. Bricklin
Bricklin & Gendler
Attorneys-at-Law
Suite 900 Fourth and Pile Bldg.
1424 Fourth Avenue
Seattle, WA 98101

APPENDIX B

FINAL EIS MAILING LIST

FOREST SERVICE

Regional Forester
USDA Forest Service
Service Federal Building
P.O. Box 7669
Ft. Collins, CO 80526

Regional Forester
USDA Forest Service
1117 W. 8th Avenue
Lakewood, CO 80225

Regional Forester
USDA Forest Service
Federal Building
517 Gold Avenue, SW
Albuquerque, NM 87102

Regional Forester
USDA Forest Service
Federal Building
324 25th Street
Ogden, UT 84401

Regional Forester
USDA Forest Service
630 Sansome Street
San Francisco, CA 94111

Regional Forester
USDA Forest Service
319 SW Pine Street
Box 2623
Portland, OR 97208

Regional Forester
USDA Forest Service
1720 Peachtree Road, NW
Atlanta, GA 30367

Regional Forester
USDA Forest Service
Henry S. Reuss Federal Plaza
Suite 500
310 W. Wisconsin Avenue
Milwaukee, WI 53203

Methods Application Group
USDA Forest Service
Suite 350, Executive Plaza
2625 Redwing Road
Ft. Collins, CO 80526

FOREST SERVICE - continued

Dr. Frank Lewis
Forest Insect and Disease Lab.
51 Mill Pond Road
Hamden, CT 06514

Dr. Normand R. Dubois
Forest Insect and Disease Lab.
51 Mill Pond Road
Hamden, CT 06514

Dr. William Wallner
Forest Insect and Disease Lab.
51 Mill Pond Road
Hamden, CT 06514

Dr. Michael L. McManus
Forest Insect and Disease Lab.
51 Mill Pond Road
Hamden, CT 06514

NEFES
Forestry Sciences Lab.
Box 365
Delaware, OH 43015

Forestry Sciences Lab.
180 Canfield Street
Morgantown, WV 26505

Pacific Northwest Station
809 NE 6th Avenue
Portland, OR 97232

Pacific Southwest Station
1960 Addison Street
Berkeley, CA 94701

Staff Director, FPM
USDA Forest Service
P.O. Box 3623
Portland, OR 97208

USDA Forest Service
Field Representative - FPM
180 Canfield Street
Morgantown, WV 26505

USDA Forest Service
Field Representative - FPM
P.O. Box640
Durham, NH 03824

FOREST SERVICE - continued

USDA Forest Service
Field Representative - FPM
1992 Folwell Avenue
St. Paul, MN 51108

USDA Forest Service
Rocky Mountain Station
240W Prospect
Fort Collins, CO 80526

USDA Forest Service
Southeastern Station
200 Weaver Boulevard
Asheville, NC 28804

USDA Forest Service
Southern Station
U.S. Postal Service Bldg.
701 Loyola Avenue
New Orleans, LA 70113

APHIS

USDA, APHIS, PPQ
1 Hartford Square West
Building 1, Third Floor
Hartford, CT 06106

USDA, APHIS, PPQ
Blason II, First Floor
505 South Lenola Road
Moorestown, NJ 08057

USDA, APHIS
South Building
12th and Independ. Ave., SW
Washington, DC 20250

USDA, APHIS, PPQ
Federal Building 663
Hyattsville, MD 20782

USDA, APHIS, PPQ
80 Wolf Road
Albany, NY 12205

USDA, APHIS
Information Division
Room 1148, South Bldg.
Washington, DC 20250

USDA, APHIS, PPQ Rural Route 6
Box 53
Wilmington, NC 28401

USDA, APHIS, PPQ
William Green Federal Building
6th & Arch Streets, Room 9452
Philadelphia, PA 19106

USDA, APHIS, PPQ
552 Lewis Cass Building
Lansing, MI 58913

USDA, APHIS
Gypsy Moth Methods Development
Laboratory
Building 1398
Otis Air Force Base, MA 02542
ATTN: C. D. Schwalbe

USDA, APHIS, PPQ
1010 Jorie Blvd., Suite 38
Oak Brook, IL 60521

USDA, APHIS, PPQ
915 Southwest Blvd.
Suite K-2
Jefferson City, MO 65101

USDA, APHIS, PPQ
3505 25th Avenue
P. O. Box 13
Gulfport, MS 39501

USDA, APHIS, PPQ
Southeastern Region
P.O. Box 3659
Gulfport, MS 39503

USDA, APHIS, PPQ
Brownett Bldg.
4080 Woodcock Drive
Suite 129
Jacksonville, FL 32207

USDA, APHIS, PPQ
FAA and NWS Building
P.O. Box 59 - 2647 AMF
Miami, FL 33159

USDA, APHIS, PPQ
727 East Durango
Federal Building, Room B-201
San Antonio, TX 78206

USDA, APHIS, PPQ
200 E. Nopal Street, Suite 208
Uvalde, TX 78801

USDA, APHIS, PPQ
Room 2315, Intl. Arrl. Bldg.
J.F. Kennedy Intl. Airport
Jamaica, NY 11430

USDA, APHIS, PPQ
Suite 400
2100 BoCA Chica Blvd.
Brownsville, TX 78521

USDA, APHIS, PPQ
Room 205, Towers Royale
520 Old Spanish Trail
Slidell, LA 70458

APHIS - continued

Dr. Roger Fuester
USDA, Beneficial Insect
Research Lab
501 South Chapel Road
Newark, DE 19713

USDA, APHIS, PPQ
620 Central Avenue
Building 2B, Room 103
Alameda, CA 94501
ATTN: Regional Director

USDA, APHIS, PPQ
3112 Federal Building
Seattle, WA 98174

USDA, APHIS, PPQ
7100 W. 44th Avenue
Suite 102
Wheat Ridge, CO 80033

USDA, APHIS, PPQ
1515 Clay Street, Room 450
Oakland, CA 94612

USDA, APHIS, PPQ
522 N. Central Avenue
Room 201
Phoenix, AZ 85004

USDA, APHIS, PPQ
40 S. Gay Street, Room 419
Baltimore, MD 21202

USDA, APHIS, PPQ
P.O. Box 50002
Honolulu, HI 96850

USDA, APHIS, PPQ
26 Federal Plaza
Room 1747
New York, NY 11430

EPA - continued

Assistant Director
Res. Liaison Development Staff
Office of Fed. Activities, A-104
537 West Tower, Waterside Mall
401 M. Street SW
Washington, DC 20460
ATTN: EIS Registration Section

Regional Admin. - Region I
Environmental Protection Agency
John F. Kennedy Federal Bldg.
Room 2303
Boston, MA 02203
ATTN: EIS Review Coordinator

Regional Admin. - Region II
Environmental Protection Agency
26 Federal Plaza, Room 908
New York, NY 10007
ATTN: EIS Review Coordinator

Regional Admin. - Region III
Environmental Protection Agency
Curtis Building, 6th Floor
6th and Walnut Streets
Philadelphia, PA 19106
ATTN: EIS Review Coordinator

Regional Admin. - Region IV
Environmental Protection Agency
1421 Peachtree Street, NE
Atlanta, GA 30309
ATTN: EIS Review Coordinator

Regional Administrator - X
Environmental Protection Agency
1200 6th Avenue
Seattle, WA 98101
ATTN: EIS Review Coordinator

Environmental Protection Agency
Office of Pesticide Programs
TS - 766C
401 M Street, SW
Washington, DC 20250

EIS Review Coordinator
EPA, Region VII
324 E. 11th Street
Kansas City, MO 64105

EPA - continued

Regional Administrator - Reg. V
Environmental Protection Agency
1 N. Wacker Drive
230 South Dearborn Street
Chicago, IL 60606
ATTN: EIS Review Coordinator

EIS Review Coordinator (GA SAF)
Environmental Protection Agency
Region VI
1201 Elm Street
Dallas, TX 75270

Douglas D. Campt, Acting Dir.
Registration Div., OPP (TS-767)
Environmental Protection Agency
401 M. Street SW
Washington, DC 20460

Deputy Asst. Administrator
for Pesticide Programs
Environmental Protection Agency
Room E-539, TS-766
401 M. Street SW
Washington, DC 20460

A.E. Conroy, II, Director
Office of Pesticides and
Toxic Substances
Enforcement Division, EN-342
Environmental Protection Agency
401 M. Street SW
Washington, DC 20460

EIS Review Coordinator
EPA, Region VIII
1860 Lincoln Street
Denver, CO 80203

EIS Review Coordinator
EPA, Region IX
215 Fremont Street
San Francisco, CA 91405

OTHER FEDERAL AGENCIES

Office of the Secretary
Environmental Quality Activities
U.S. Dept. of Agriculture
Room 307-A, Administration Bldg.
Washington, DC 20250
ATTN: Coordinator, Room 412A

U. S. Dept. of Agriculture
Science and Education Admin.
Room 307-A, Admin. Bldg.
Washington, DC 20250
ATTN: Director

U.S. Dept. of Agriculture
Environmental Services Division
Soil Conservation Service
Room 6103, South Building
Washington, DC 20250
ATTN: Director 30333

Director
Office of Environ. Affairs
Dept. of Health, Education
and Human Services
524, FS HHS, South
Washington, DC 20201

Assistant Secretary for
Environmental Affairs
US Department of Commerce
Room 3425
Washington, DC 20230

Waldemar Klassen
USDA - SEA/AR National
Program Staff
Room 336, Building 005
Agriculture Research Center
Beltsville, MD 20705

Assistant Manager of Natural
Resources (Environment)
Tennessee Valley Authority
TVA Mailroom
Knoxville, TN 37902

Director
Environmental Project Review
Department of Interior
Room 4526, Interior Bldg.
18th and C St.
Washington, DC 20240

OTHER FEDERAL AGENCIES - continued

Dr. Sydney Galler
Deputy Asst. Secretary for
Environmental Affairs
U.S. Department of Commerce
Washington, DC 20230

Frank S. Lisella, PH.D
Chief, Environ. Affairs Group
Environmental Health Services
Division, BSS
U.S. Public Health Service
Center for Disease Control
Atlanta, GA 30333

James Nielson
Joint Planning and Evaluation
Science and Education Admin.
U.S. Department of Agriculture
Washington, DC 20250

Calvin Menzie
FWS/ES
U.S. Department of Interior
Washington, DC 20240

Harry A. Rainbolt, Area Director
U.S. Department of the Interior
Bureau of Indian Affairs
Eastern Area Office
1951 Constitution Avenue, NW
Washington, DC 20250

Michael Cook
Assistant Tribal Planner
St. Regis Mohawk Reservation
Community Bldg.
Hogansburg, NY 13655

Gregg Stevens
Eastern Area Office
Bureau of Indian Affairs
1000 N. Glebe Road
Arlington, VA 22201

U.S. Navy (USN)
Office of Chief of Navy Oper.
Environment Protection Div.
OP-45, Room BD 766, Pentagon
Washington, DC 20350

OTHER FEDERAL AGENCIES - continued

Harvey Schultz, Head
Applied Biology Section
Code 1142, Northern Division
Philadelphia Naval Base
Facilities Engineering Command
Philadelphia, PA 19112

Dr. Terry Biery
Department of the Air Force
355 TAS/Aerial Spray
Rickenbacker ANGB, Ohio 43217

Joseph L. Deschenes, Forester
Building 667-B, DEH
Department of the Army
United States Military Academy
West Point, NY 10996

Army Corps of Engineers (COE)
Headquarters, ATTN: DAEN-ZCE
Washington, D.C. 20301

RIVER BASIN COMMISSIONS

U.S. Commissioner
Susquehanna River Basin Comm.
Interior Building, Room 6246
Washington, DC 20240

Head Environmental Unit
Delaware River Basin Commission
P.O. Box 360
Trenton, NJ 08603

NATIONAL PARK SERVICE

Superintendent
Harpers Ferry National
Historical Park
P.O. Box 65
Harpers Ferry, WV 25425

Superintendent
Chesapeake and Ohio Canal
National Historic Park
P.O. Box 158
Sharpsburg, MD 21782

National Park Service
Division of Natural Resources
Washington, DC 20240
ATTN: Michael Ruggiero

General Superintendent
Allegheny Portage Railroad
National Historic Site
P.O. Box 247
Cresson, PA 16630

Superintendent
Delaware Water Gap National
Recreation Area
Bushkill, PA 18324

Superintendent
Gettysburg National Military
Park
Gettysburg, PA 17325

Superintendent
Hopewell Village National
Historic Site
R.D. #1, Box 345
Elverson, PA 19520

Superintendent
Valley Forge National
Historical Park
Valley Forge, PA 19481

Project Manager
Appalachian Trail Project Office
Harpers Ferry Center
Harpers Ferry, WV 25425

Biological Resources Division
National Park Service
U.S. Department of the Interior
Washington, DC 20240

NATIONAL PARK SERVICE - continued

Superintendent
Cape Cod National Seashore
South Wellfleet, MA 02663

Superintendent
Antietam National Battlefield
Site
P.O. Box 158
Sharpsburg, MD 21782

National Park Service
National Capital Region
1100 Ohio Drive, SW
Washington, DC 20240
ATTN: Bill Anderson

Director
National Park Service
SE Region
75 Spring Street
Atlanta, GA 30303

State Clearinghouse
Office of State Planning & Energy
Dept. of Administration
1 West Wilson Street Rm. B-130
State Office Building
Madison, WI 53702

Office of the Governor
State Planning and Community
Affairs Agency
Olympia, WA 98504

Office of State Planning
Dept. of Finance and Control
340 Capitol Avenue
Hartford, CT 06115

Connecticut State Clearinghouse
Office of Policy & Management
Intergovernmental Relations Div.
80 Washington Street
Hartford, CT 06115

Office of Management,
Budget and Planning
Townsend Building, 3rd Floor
P. O. Box 1401
Dover, DE 19901

State Planning Office
State of Maine
184 State Street
Augusta, ME 04333

Department of State Planning
301 West Preston Street
Baltimore, MD 21201

Coordinator of Federal Funds
Office of the Governor
State House
Concord, NH 03301

Missouri State Clearinghouse
Office of Administration
Division of Budget & Planning
P.O. Box 809 State Capitol
Jefferson City, MO 65101

Pennsylvania State Clearinghouse
Governor's Budget Office
Intergovernmental Relations Div.
Box 1323
Harrisburg, PA 17120

Division of State and Regional
Planning
Department of Community Affairs
P. O. Box 2768
Trenton, NJ 08625

State Clearinghouse
NY State Division of Budget
Albany, NY 12224

State Clearinghouse
State Planning Division
Department of Administration
116 W. Jones Street
Raleigh, NC 27611

The Ohio State Clearing House
Office of Budget & Management
30 E. Broad St., Rm. 3949
Columbus, OH 43215
ATTN: Francien Metzger

State Clearinghouse
Grants and Contracts Review
Unit
State Auditor, P.O. Box 11333
Columbia, SC 29211

The State Clearinghouse
State Planning Office
Pavillion Office Building
Montpelier, VT 05602

State Clearing House
Governor's Office of Economic
and Community Development
Building #6, Rm 553-B
State Capitol Complex
Charleston, WV 25305

Executive Office of Communities
and Development
100 Cambridge Street
Boston, MA 02202

A95 Clearinghouse Coordinator
Rhode Island Statewide Planning
Programs
Department of Administration
Room 201
265 Melrose Street
Providence, RI 02907
ATTN: Rene J. Fontaine

Nebraska State Clearinghouse
Planning and Programming
State Capitol
Box 94601
Lincoln, NE 68509

State Clearinghouse
Bureau of the Budget
Lincoln Tower Plaza
524 S. Second Street, Room 315
Springfield, IL 62706

Iowa State Clearinghouse
Office for Planning and
Programming
523 East 12th Street
Des Moines, IA 50319

Indiana State Clearinghouse
Planning Services Agency
Grants Review Section
Indianapolis, IN 46204

State Clearinghouse
Office of Policy and Management
209 Capitol Annex
Frankfort, KY 40601

Michigan Depart. of Commerce
Environmental Review Board
P. O. Box 30004, Fourth Floor
Lansing, MI 48909

Charles Ellis, III
Commonwealth of Virginia
Council on the Environment
903 9th Street Office Bldg.
Richmond, VA 23219

STATE CLEARINGHOUSES - continued

Federal Aid Coordinator
Intergovernmental Relations Div.
Execut. Department
306 State Library Bldg.
Salem, OR 97310

California State Clearinghouse
Office of the Governor
Office of Planning and Research
1400 Tenth Street
State Office of
Sacramento, CA 95814

State Clearinghouse
Minnesota State Planning Agency
101 Capitol Square Building
St. Paul, MN 55101

State Clearinghouse
Office of Planning and Budget
Room 610
270 Washington Street, SW
Atlanta, GA 30334

State Clearinghouse
Alabama Development Office
c/o State Capitol
Montgomery, AL 36130

State Clearinghouse
State Planning Office
1800 James K. Polk Office Bldg.
505 Deaderick Street
Nashville, TN 37219

Bureau of Intergovernmental
Relations
Div. of State Planning, Dept. of
Administration
6600 Apalachee Parkway
Tallahassee, FL 32304

Office of State Clearinghouse
Dept. of Urban & Comm. Affairs
Box 44455
Baton Rouge, LA 70804

State Clearinghouse
MS810707-006
1303 Sillers Bldg.
500 High Street
Jackson, MS 39202

STATE CLEARINGHOUSES - continued

Dept. of Econ. & Comm. Affairs
Lincoln Plaza Bldg., Suite 285
4545 North Lincoln Boulevard
Oklahoma City, OK 73105

Gov's Budget & Planning Office
P. O. Box 13561
Austin, TX 78701
ATTN: Darla Parker

STATE FORESTRY AGENCIES

Walter F. Gabel
DE Department of Agriculture
Forestry Section
Drawer D
Dover, DE 19903

Kenneth G. Stratton
Bureau of Forestry
State House Station #22
Augusta, ME 04333

Robert L. Garrepy
Department of Environmental
Protection, Forestry Unit
State Office Building, Rm. 260
165 Capitol Avenue
Hartford, CT 16106

State Forester
Forest and Park Services
Tawes State Office Building
580 Taylor Avenue
Annapolis, MD 21401

Gilbert A. Bliss
Division of Forest & Parks
100 Cambridge Street
Boston, MA 02202

Henry H. Webster
Forest Management Division
MI Dept. of Natural Resources
Stevens T. Mason Building
Box 30028
Lansing, MI 48909

Raymond B. Hitchcock
Division of Forestry
Centennial Office Building
658 Cedar Street
St. Paul, MN 55155

Henry J. Deion, Jr.
Division of Forest Environment
Box 851, RFD #2
North Scituate, RI 02857

Theodore Natti, Director
Division of Forests & Parks
Dept. of Resources and Economics
Box 856, 105 Loudon Road
Concord, NH 03301

State Forester
Bureau of Forest Management
CN-404
Trenton, NJ 08625

Norman J. VanValkenburgh
Division of Lands & Forests
Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001

State Forester
Division of Forest Resources
P. O. Box 27687
Raleigh, NC 27611

State Forester
ODNR Division of Forestry
Fountain Square, Bldg C-3
Columbus, OH 43224

Richard R. Thorpe
Bureau of Forestry
Department of Environmental Resources
109 Evangelical Press Building
P.O. Box 1467
Third and Reily Streets
Harrisburg, PA 17120

Milton E. Reinke
Department of Natural Resources
101 S. Webster Street
P. O. Box 7921
Madison, WI 53703

State Forester
Iowa State Conservation Comm.
Wallace State Office Bldg.
Des Moines, Iowa 50319

Leonard A. Kilian, Jr.
SC Commission of Forestry
P.O. Box 21707
Columbia, SC 29221

E. Bradford Walker
Director of Forests
Department of Forests, Parks and Recreation
Montpelier, VT 05602

STATE FORESTRY AGENCIES - continued

Wallace F. Custard
Virginia Division of Forestry
P. O. Box 3758
Charlottesville, VA 22903

B. J. Warder
Department of Natural Resources
1800 Washington Street, E.
Charleston, WV 25305

State Forester
Forestry Division
2901 North 10-Mile Drive
Box 180
Jefferson City, Missouri 65102

State Forester
Division of Forest Resources and Natural Heritage
600 North Grand Avenue West
Springfield, Illinois 62707

State Forester
Department of Natural Resources
Division of Forestry
State Office Building
Indianapolis, Indiana 46204

C.W. Moody, State Forester
Alabama Forestry Commission
513 Madison Avenue
Montgomery, AL 36180

Michael P. Mety, State Forester
Arkansas Forestry Commission
P. O. Box 4523 Asher Station
Little Rock, AR 72214

John M. Bethea, Director
Florida Div. of Forestry
Florida Dept. of Agriculture and Consumer Services
3125 Conner Blvd.
Tallahassee, FL 32301

John Mixon, Director
Georgia Forestry Commission
P. O. Box 819
Macon, GA 31298-3237

STATE FORESTRY AGENCIES - continued

Donald A. Hamm, Director
Kentucky Division of Forestry
627 Commanche Trail
Frankfort, KY 40601-1798

Donald L. McFatter
Assistant Secretary
Office of Forestry
Dept. of Natural Resources
P. O. Box 1628
Baton Rouge, LA 70821

H.J. (BOE) Green, Director
Division of Forest Resources
NC Dept. of Natural Resources and Community Development
Box 27687
Raleigh, NC 27611

Roger L. Davis, Director
Forestry Division, Dept. of Agr.
122 State Capitol Bldg.
Oklahoma City, OK 73105

Leonard A. Kilian, Jr., State For.
Commission of Forestry
P. O. Box 21707
Columbia, SC 29221

Roy C. Ashley, State Forester
Tennessee Division of Forestry
Department of Conservation
701 Broadway
Nashville, TN 37203

Bruce R. Miles, Director
Texas Forest Service
Systems Admn. Building
College Station, TX 77843

James W. Garner, Jr.
State Forester
VA Division of Forestry
P. O. Box 3758
Charlottesville, VA 22903-0758

OTHER STATE AGENCIES

John W. Impson, Ph.D., Director
Office of Agricultural and Environmental Sciences
Louisiana Dept. of Agriculture
Baton Rouge, LA 70804

Assistant Director
WA Department of Agriculture
Plant Industry Division
406 General Administration Bldg. MS:AX-41
Olympia, WA 98504

Walter H. Patch, Director
Division of Plant Industry
WY Department of Agriculture
2219 Carey Avenue
Cheyenne, WY 82002

Thomas J. Durkis
NH Dept. of Agriculture
RFD #1, Box 45
Laconia, NH 03246

David Struble
Maine Forest Service
Harlow Building
Augusta, ME 04333

James R. White, Director
Division of Plant Industries
TN Department of Agriculture
P.O. Box 40627
Melrose Station
Nashville, TN 37204

David A. Ivie
Director of Agricultural & Environmental Sciences
TX Department of Agriculture
P.O. Box 12847
Capitol Station
Austin, TX 78711

Edward Bianco
State Entomologist
Division of Plant Industry
Utah Department of Agriculture
147 North 200 West
Salt Lake City, UT 84103

Director
North Carolina Department
of Agriculture
Pesticide & Plant Protection Div.
P. O. Box 27647
Raleigh, NC 27611

Matthew Scott
Maine Department of Environmental
Protection
Station 17
Augusta, ME 04333

Vincent A. Sikora
Dept. of Environmental Health
P.O. Box 24376, ETSU
Johnson City, TN 37601

Director
Division of Plant Industry
State Department of Agriculture
CN 330
Trenton, NJ 08625

Administrator
Plant Industry Division
Montana Department of Agriculture
Agriculture/Livestock Building
Capitol Station
Helena, MT 59620

State Entomologist
Bureau of Plant Industry
NE Department of Agriculture
P.O. Box 94756
Lincoln, NE 68509

Office of State Entomologist
NH Department of Agriculture
State Lab Building, Lab D
Hazen Drive
Concord, NH 03301

Chief
Division of Plant Industry
New Mexico Department of
Agriculture
P.O. Box 3 BA
Las Cruces, NM 88003

OTHER STATE AGENCIES - continued

Director
Division of Plant Industry
MN Department of Agriculture
90 West Plato Blvd.
St. Paul, MN 55107

Director
Department of Conservation
and Economic Development
1100 State Office Building
Richmond, VA 23219

Director
Department of Agriculture
Trade and Consumer Protection
801 Westbadger Road
P. O. Box 8911
Madison, WI 53708

Daniel S. Green
State of West Virginia
Governor's Office of Economic
and Community Development
Charleston, WV 25305

Director
AZ Commission of Agriculture
and Horticulture
1688 West Adams, Rm 421
Phoenix, AZ 85007

Director
New York State Department of
Agriculture and Markets
Building 8 - State Campus
Albany, NY 12235

Lawrence J. Ehlers
ODNR Division of Forestry
Fountain Square
Building C-3
Columbus, OH 43224

Director
Agricultural Chemical Plant
Industry Division
Department of Agriculture
& Industries
P.O. Box 3336
Montgomery, AL 36193

Dave Rimmd
Bergen County Park Commission
Paramus, NJ 07652

Dr. John F. Anderson
Connecticut Agriculture
Experiment Station
123 Huntington St.
P. O. Box 1106
New Haven, CT 06504

M. C. Remion
South Carolina Forestry Comm.
P. O. Box 21707
Columbia, SC 29221

Daniel G. Mosher
Michigan Department of
Natural Resources
Forest Management Division
P.O. Box 30028
Lansing, MI 48909

Charles S. Hood
Massachusett Department of
Environmental Management
100 Cambridge St.
Boston, MA 02202

John D. Kegg
Supervisory Entomologist
NJ Department of Agriculture
CN 330
Trenton, NJ 08625

Director
Plant Pest Control Division
State Department of Agriculture
Charleston, WV 25305

Director
Bureau of Plant Industry
PA Department of Agriculture
Agriculture Building
2301 North Cameron Street
Harrisburg, PA 17110

Don Patterson
Department Office of Pest Control
380 Scotch Road
W. Trenton, NJ 08625

OTHER STATE AGENCIES - continued

Chief
Division of Plant Industry
State Department of Agriculture
P.O. Box 30017
Lansing, MI 48909

Director
Division of Plant Pest Control
State Department of Agriculture
State Office Building
116 State Street
Montpelier, VT 05602

Charles W. Puffinberger
Assistant Secretary
MD Department of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401

Alden S. Hopkins
State Department of Agriculture
P.O. Drawer D
Dover, DE 19901

Director
Division of Plant Industry
State Department of Agriculture
Station 28
Augusta, ME 04330

Director
Entomology Division
State Department of Agriculture
P.O. Box 2881
Raleigh, NC 27611

Director
Division of Plant Pest Control
State Department of Agriculture
State Office Building
100 Cambridge Street
Boston, MA 02202

Director
Division of Plant Industry
State Dept. of Agr. & Markets
Building 8, State Campus
Albany, NY 12226

VA Dept. of Agri. & Cons. Ser.
Div. of Product & Industry Reg.
Plant Pest Control Section
203 North Governor Street, R-308
Richmond, VA 23219

Kenneth E. Roberts, Administrator
Plant Industry Division
WI Department of Agriculture
801 Badger Road
Madison, WI 53713

Harold L. Porter, Chief
Division of Plant Industry
Ohio Department of Agriculture
8995 E. Main Street
Reynoldsburg, OH 43068

State Entomologist
Plant Pest Regulatory Service
Clemson University
Clemson, SC 29631

Director
Division of Plant Industry
California Department of Food
and Agriculture
1220 N Street
Sacramento, CA 95814

Morton Friedman
Department Office of Science
L & I, Rm. 803
P.O. Box 1390
Trenton, NJ 08625

Director
Division of Plant Industry
State Plant Board
P.O. Box 1069
Little Rock, AR 72203

Director
Pennsylvania Game Commission
8000 Derry Street
P.O. Box 1567
Harrisburg, PA 17120

A. G. Woodent
Saratoga County
Vector Control Program
40 Memostar Street
Ballston Spa, NY 12020

Elizabeth S. Hendrick
Westchester County Health Depart.
Bureau of Environmental Quality
150 Grand Street
White Plains, NY 10601

OTHER STATE AGENCIES - continued

Jay Casey
Rennselaer County
EAEC's Office
County Office Building
1600 7th Avenue
Troy, NY 12180

James O. Nichols
PA Bureau of Forestry
34 Airport Drive
Middletown, PA 17057

Kevin C. Donnelly
Blackbird State Forest
RD 2, Box 2186
Symrna, DE 19977

Director
Division of Plant Industry
FL Department of Agriculture
and Consumer Services
P.O. Box 1269
Gainesville, FL 32602

Jack Hill
Dutchess County Dept. of Health
22 Market Street
Poughkeepsie, NY 12601

W. P. Campbell, Associate Director
Plant Quarantine
Plant Products and Quarantine
Division
Canada Agriculture
Ottawa, Ontario CANADA K1A 0C6

Director
Division of Plant Industry
Colorado Dept. of Agriculture
State Services Building
1525 Sherman Street
Denver, CO 80203

Elroy Begalka
Plant Quarantine & Apiary Off.
Div. of Agri. Reg. & Inspection
SD Dept. of Agriculture
Anderson Building
Pierre, SD 57501

Gene Grifo
Bureau of State Parks
Box 1467
Harrisburg, PA 17120

State Entomologist
Division of Plant Industries
Idaho Department of Agriculture
P.O. Box 790
Boise, ID 83701

H. Dean Garwood, Director
Division of Entomology
KS State Board of Agriculture
901 Kansas Avenue
Topeka, KS 66612

Marshall Wiebe
Department of Conservation
Station 22
Augusta, ME 04333

John Bailey
Maine Legislative Staff
State House
Augusta, ME 04333

Director
IL Department of Agriculture
Bureau of Plant and Apiary
Protection
1010 Jorie Blvd., Room 20
Oakbrook, IL 60521

Jon P. Turmel, Entomologist
VT Department of Agriculture
Plant Industry Division
116 State Street
Montpelier, VT 05670

Joseph W. Scott
State Horticulturalist
Department of Agriculture
Station 28
Augusta, ME 04333

Victor Bell
Division of Planning
Department of Environmental
Management
83 Park Street
Providence, RI 02903

Paul C. Weikel
Pennsylvania Game Commission
Division of Land Management
P.O. Box 1567
Harrisburg, PA 17115

OTHER STATE AGENCIES - continued

Stephen C. Mandes, Exec. Dir.
Southern Alleghenies Planning &
Development Commission
South Alleghenies Plaza
Suite 100
1506 Eleventh Avenue
Altoona, PA 16601

Thomas L. Cobb, Ph.D
Environmental Management Bureau
NY State Parks & Recreation
Agency Building 1
Empire State Plaza
Albany, NY 12238

Al Prey
WI Department of Natural Res.
3911 Fish Hatchery Road
Madison, WI 53711

Carl M. Scott, Jr., Director
Division of Entomology
GA Department of Agriculture
Agriculture Building
Capitol Square
Atlanta, GA 30334

William J. Brandvik,
ND Dept. of Agriculture
State Capitol
Bismark, ND 58505

Joe Markle, Plant Supervisor
Plant Industry Division
OK Department of Agriculture
122 State Capitol Building
Oklahoma City, OK 73105

William H. Kosesan, Admin.
Plant Division
OR Department of Agriculture
Agricultural Building
Salem, OR 97310

Carl Carlson, State Ent.
IA Department of Agriculture
Wallace Building
East 9th and Grand
Des Moines, IA 50319

Lester Barrows, Director
Plant Industries Division
Missouri Department of
Agriculture
P.O. Box 630
Jefferson City, MO 65101

Chief
Division of Water Resources/DEM
Cannon Health Building
Room #209
75 Davis Street
Providence, RI 02908

Peter M. Janaros, Chief
Division of Land Resources/DEM
Cannon Health Building
Room #204
75 Davis Street
Providence, RI 02908

Alfred C. Avery
Fox State Forest
Hillsboro, NH 03244

Director
Pesticide Control Board
Department of Agriculture
Station 28, State House
Augusta, ME 04333

George A. LaBonte
Maine Forest Service
Harlow Building
Augusta, ME 04333

William E. Orsino
Bureau of Pesticides
50 Wolf Road
Room 404
Albany, NY 12233

Charles Kurzius
Department of Parks
475 Valley Road
Wayne, NJ 07470

Frank J. Schrey, III, Chief
Commonwealth of Pennsylvania
Department of Commerce
453 Forum Building
Harrisburg, PA 17120

OTHER STATE AGENCIES - continued

Frederick L. Marshall
Cooperative Extension Agent
Westchester County
216 Central Avenue
White Plains, NY 10606

John Cronan, Chief
Division of Fish and Wildlife
DEM/Washington County Government
Center
Tower Hill Road
Wakefield, RI 02879

John J. Favinger, State Ent.
Division of Entomology
IN Department of Natural Res.
613 Indiana State Office Bldg.
Indianapolis, IN 46204

State Entomologist
Division of Plant Industry
Mississippi Department of
Agriculture and Commerce
P.O. Box 5207
Mississippi State, MS 39762

Broome County Environmental
Management Council
County Office Building
Box 1766
Binghamton, NY 13902

Albert E. Cole
Plant Pest Control Division
Department of Agriculture
Charleston, WV 25305

Keith Jones, Superintendent
Forestry Department
227 Park Avenue
Portland, ME 04333

Director
Division of Plant Industry
Nevada Department of Agriculture
P.O. Box 11100
Reno, Nevada 89510

Ralph A. Beswick, Supervisor
Washington Dept. of Agriculture
Olympia, WA 98504

OTHER STATE AGENCIES - continued

T. Frank Goodson
Assistant Secretary
for Resources
Resource Agency of California
Resources Building
1416 Ninth Street
Sacramento, CA 95814

Sue Fisher, Division of Planning
Department of Environmental
Management
83 Park Street
Providence, RI 02903

Donald H. Kludy
Plant Pest Control Section - PAIR
VA Dept. of Agriculture and
Consumer Services
203 North Govenor Street, Rm. 308
Richmond, VA 23219

Dept. of Environmental Resources
Bureau of Forestry
401 Penn Street, P.O. Box 403
Huntingdon, PA 16652

B. J. Mickleson
Dept. of Agriculture
407 General Admin. Building
Olympia, VA 98504

C. L. Morris
Dept. of Conservation &
Economic Development
Division of Forestry, Box 3758
Charlottesville, VA 22903

Marlin Conrad
Supervisor State/Fed Programs
Wisconsin Dept. of Agriculture
Plant Industry Division
801 West Badger Road
Madison, WI 53713

PRIVATE ORGANIZATIONS

Cindy Rotz
Joint Conservation Committee
Box 254 Main Capitol
Harrisburg, PA 17113

Larry Enoch
Hudson River
Sloop Clear Water Inc.
112 Market Street
Poughkeepsie, NY 12601

Mary T. Prah
NY Environmental News
ASRC - SUNYA
Albany, NY 12222

Sierra Club
196 Morton Avenue
Albany, NY 12202

Representative, Sierra Club
330 Pennsylvania Ave., SE
Washington, DC 20003

Arthur P. Cooley
Environmental Defense Fund
341 Durkee Lane
E. Patchogue, NY 11772

Gil Zemansky
Friends of the Earth
4512 University Way, NE
Seattle, WA 98105

Linda Jean Hiltbold
P.A.U.S.E.
130 Selma Blvd.
Randolph, NJ 07869

Robert H. Gardiner
Natural Resources Council of ME
271 State Street
Augusta, ME 04333

Cheryl Ring
Maine Audubon Society
118 Route One
Falmouth, ME 04105

York Audubon Society
c/o Larry Pritt
RD # 1, Box 283
Windsor, PA 17366

National Audubon
Northeast Regional Office
Sharon Audubon Center
Route 4
Sharon, CT 06069

Morley Felton
Information Consultant
Household Ecology Information
Center
37 Crawford Road
Audubon, PA 19403

Alfred L. Hawkes, Executive Dir.
Audubon Society of Rhode Island
40 Bowen Street
Providence, RI 02903

James T. Gaffney
Executive Director
Stony Brook-Millstone
Watersheds Assoc.
R.D. 1, Box 263-A
Titusmill Road
Pennington, NJ 08524

Liz Rodrigues, Secretary
New Jersey Beekeepers
Association, Inc.
157 Five Point Road
Colts Neck, NJ 07722

Frank Zettle
Environmental Committee
Spring Creek Chapter T.U.
616 Sunselt Road
State College, PA 16801

Director
ANJEC
300 Mendham Road, Box 157
Mendham, NJ 07945

Phoebe Wray
Executive Director
The Center for Action on
Endangered Species
Ayer, MA 01432

PRIVATE ORGANIZATIONS - continued

Izaak Walton League of America
1701 N. Fort Myer Drive
Suite 1100
Arlington, VA 22209

Dr. I. C. T. Nisbet
Massachusetts Audubon Society
Codman Road
Lincoln, MA 01773

Johanna Rand
City of Waterville
Box 373
Waterville, ME 04901

Nancy Coleman
Parsippany Committee for
Gypsy Moth
4 Crawford Road
Morris Plains, NJ 07950

Paul Finger
Thompkins County Environmental
Management Council
128 East Buffalo Street
Ithaca, NY 14850

Richard L. Plunkett
National Audubon Society
950 Third Avenue
New York, NY 10022

National Wildlife Federation
1412 16th Street, NW
Washington, DC 20036

Director
Scientific Staff
Massachusetts Audubon Society
Lincoln, MA 01773

Pat Miller
Citizen for Responsible
Action on Gypsy Moth
RFD Newfield Road
Waterboro, ME 04087

Larry N. Sokol
Jolles, Sokol and Bernstein,
P.C.
721 S.W. Oak Street
Portland, OR 97205

PRIVATE ORGANIZATIONS - continued

Western Washington Toxics Coalition
4512 University Way N.E.
Seattle, WA 98105

Robert Ginsburg
Citizens for a Better Environment
Suite 1600
59 East Van Buren Street
Chicago, IL 60605

Steve Dreistadt
Citizens for a Better Environment
942 Market St., Suite 505
San Francisco, CA 94102

Neal Fitzpatrick
Audubon Naturalist Society
8940 Jones Mill Road
Chevy Chase, MD 20815

Oregon Environmental Council
130 Northwest 114th Street
Portland, Oregon 97229

Alabama Conservancy
1816 E. 28th Avenue, S
Birmingham, AL 35209

Alabama Envir. Quality Assoc.
3815 Interstate Court
Suite 202
Montgomery, AL 36109

American Alliance For Hper.
1201 16th St., NW
Washington, DC 20036

American Forest Institute
1619 Massachusetts Ave., NW
Washington, DC 20036

Mr. W.D. Page
American Plywood Association
1581 Phoenix Blvd., Suite 6
Atlanta, GA 30340

Martha McKinney, Exec. Dir.
Appalachian Consortium, Inc.
202 Appalachian St.
Boone, NC 28707

PRIVATE ORGANIZATIONS - continued

James Gundy
Appalachian Hardwood Mfg. Council
P. O. Box 427
High Point, NC 27261

Conservation Foundation
1717 Massachusetts Avenue, NW
Washington, DC 20036

Environmental Defense Fund
Mr. David W. Hoskins
447 Park Avenue South
New York, NY 10016

Forest Farmers Association
P. O. Box 95385
4 Executive Park East, NE
Atlanta, GA 30347

G. Robert Kerr
The Georgia Conservancy
3110 Maple Dr., Suite 407
Atlanta, GA 30305

Lumber Mfg. Assoc. of VA
Mr. Randy Bush
220 E. Williamsburg Road, POB U
Sandston, VA 23150

Director
National Wildlife Federation
1412 Sixteenth St., NW
Washington, DC 20036

Gene Bergoffen
National Forest Products Assoc.
1619 Massachusetts Avenue, NW
Washington, DC 20036

Thomas Masingale
NC Nature Conservancy
P. O. Box 805
Chapel Hill, NC 27514

PRIVATE ORGANIZATIONS - continued

President, Ozark Society
P. O. Box 2914
Little Rock, AR 72203

George Kelly, Exec. VP
Southern Hardwood Lumber Mfg. Ass.
805 Sterick Bldg.
Memphis, TN 38103

Ron Hufford
Southern Forest Products Assoc.
P. O. Box 52468
New Orleans, LA 70152

Charles M. Clusen
The Wilderness Society
1901 Pennsylvania Avenue, NW
Washington, DC 20036

Virginia Wilderness Committee
Mr. Ed Clark, Jr., President
P. O. Box 7
Flint Hill, VA 22627

Potomac Appalachian Trail Club
1718 N Street, NW
Washington, DC 20036

Appalachian Regional Commission
Robert W. Scott
1666 Conn. Avenue, NW
Washington, DC 20235

John E. Bonine and Michael Axline
Pacific N.W. Resource Clinic
Law Center
University of Oregon
Eugene, OR 97403
For: Citizens For The Safe
Control of The Gypsy Moth
Elaine Olsen
Glen Olsen

UNIVERSITY

Edward Duda
University of Connecticut
Barlett Arboretum
Sanford, CT 06903

H. B. Jackson, Head
Plant Pest Reg. Service
210 Barre Hall, Clemson Univ.
Clemson, SC 92631

Ms. Christine DeGolyer
Assistant Librarian
State University of New York
at Binghamton
Binghamton, NY 13901

Dr. Gerald Nordin
Department of Entomology
University of Kentucky
Agriculture Science Bldg.
Lexington, KY 40546

Dr. Dale Bray
Department of Entomology
& Applied Ecology
University of Delaware
Newark, DE 19711

Larry Abrahamson
School of Forestry
State University of NY
College of Environmental
Science and Forestry
Syracuse, NY 13210

Donald A. Eggen
State University of NY
College of Envir. Sci.
& Forestry
Syracuse, NY 13210

Dr. J. B. Dimond
Assoc. Professor of Entomology
Entomology Department
Deering Hall
University of Maine
Orono, ME 04473

Mr. Geller
Stockton State College
Pomona, NJ 08240

Hugh L. Evans, Ph.D.
Environmental Medicine
NY University Medical Center
550 First Avenue
New York, NY 10016

Roger A. Morse
Cornell University
Office of Apiculture
Department of Entomology
Ithaca, NY 14853

Dr. F. Russell Cole
Department of Biology
Colby College
Waterville, ME 04901

Ronald L. Giese
Department of Forestry
School of Natural Resources
The University of Wisconsin
1630 Linden Drive
Madison, WI 53706

David H. Firmage
Biology Department
Colby College
Waterville, ME 04901

David L. Jennings
Cornell Cooperative Extension Association
County Court House
Troy, NY 12180

Dr. Alan Cameron, Asst. Prof
Department of Entomology
106 Patterson Building
Pennsylvania State University
University Park, PA 16802

Dr. John Van Camp
Department of Entomology
613 State Office Building
Indianapolis, IN 46204

Dr. Douglas C. Allen
College of Environmental Science and Forestry
Syracuse, NY 13210

UNIVERSITY - continued

Dr. Andrew J. Forgash
Department of Entomology and Economic Zoology
Rutgers University
Box 231, Cook College
New Brunswick, NJ 08903

Dr. Jay H. Cravens
Associate Professor of Forestry
College of Natural Resources
University of Wisconsin
Steven Point, WI 54481

Dr. Kent T. Adair, Dean
School of Forestry
Stephen F. Austin University
Nacogdoches, TX 75961

Dr. B.H. Box, Dean
College of Forest & Rec. Res.
Clemson University
Clemson, SC 29631

Dr. Emmett Thompson
Auburn University
Department of Forestry
Auburn, AL 36849

Dr. Benjamin A. Jayne, Dean
School of Forestry and Environmental Studies
Duke University
Durham, NC 27706

Dr. G. A. Bradley
Dept. of Horticulture and For.
University of Arkansas
Fayetteville, AR 72701

Dean
School of Forest Resources
University of Georgia
Athens, GA 30602

Dr. Thomas Hansbourough
School of Forestry and Wildlife Management
Louisiana State University
Baton Rouge, LA 70803

UNIVERSITY - continued

Dr. Bart Thielges
School of Forestry
University of Kentucky
Lexington, KY 40506

Dean
School of Forest Resources
Mississippi State University
Mississippi State, MS 39762

Dr. Eric Ellwood, Dean
School of Forestry
NC State University
Raleigh, NC 27607

Dr. Charles Lee
Dept. of Forest Science
Texas A&M University
College Station, TX 77843

Dr. J. F. Hosne
School of Forestry
VPI & State University
Blacksburg, VA 24061

Dr. G. G. Schneider
Department of Forestry
University of Tennessee
Knoxville, TN 37901

James E. Neal
205 Barrow Hall
University of Georgia
Athens, GA 30602

INDUSTRY

Vic Richards
Precision Air Services Inc.
Box 406
Union, ME 04862

Carl VanHusen
Scott Paper Company
Winslow, ME 04901

Jerry Williams
International Paper Company
9 Green Street
Augusta, ME 04330

Kerry Huckins
Boise Cascade Paper Group
Rumford, ME 04276

J. E. Moore
American Pulpwood Association
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

Robert J. LaBar
Forest Lands Manager
Hammermill Paper Company
P.O. Box 10050
Erie, PA 16533

De Renzo and Company
707 Delaware Avenue
Elmua, NY 14904
ATTN: Rick Bachert

Robert W. Piper, Jr.
Kimball Forestry Consultants
615 West Highland Avenue
Ebensburg, PA 15931

Barry M. Tibbetts
Scott Paper Company
Box 646
Bingham, ME 04920

Donald Hawkins
National Campground Owners
Association
804 "D" Street, NE
Washington, DC 20002

C. F. Glattfelder, Vice Pres.
& General Manager
The Glatfelter Pulpwood Company
Spring Grove, PA 17362

W. Lester Brown
Director of Woodlands
Bowater Incorporated
P.O. Box 1028
Greenville, SC 29602

Wilbur E. Wolfe, Jr.
The Glatfelter Pulpwood Co.
25 S. Hanover Street
Carlise, PA 17013

Robert Sand, Forester
Cotton-Hanlon Inc.
Forestry Department
Cayuta, NY 14824

H. Gilbertson
The Davey Tree Expert Co.
117 S. Water Street
Kent, OH 44240

Wilbur K. Guiffre
RD 1, Box 16
Cayuta, NY 14824

I. Frederick Trew
WESTVACO Corp.
P.O. Box 127
Crozet, VA 22932

Steve Dianus
Weyerhaeuser Company
Rt. 3, Box 282
Washington, DC 27889

INDUSTRY - continued

Alberto R. Quisumbling, Ph.D
Hercon/Herculite Products Inc.
1107 Broadway
New York, NY 10010

J. Drew Foster
Foster Agriculture Services
Box 224, Bridgepoint Road
Bridgeport Road
Belle Mead, NJ 08502

Bill Williams
Abbott Laboratories
1807 Theresa Way
Landsdale, PA 19446

Jeff Duflo
Duflo Spray Chemical
Route 812
New Bremen, NY 13412

Dr. A. A. DiEdwardo
Beeco Products Company
Industrial Park
Fort Washington, PA 19034

Kay M. Peters
Uniroyal Chemical
32 Spencer Street
Naugatuck, CT 06770

Mr. Tamotsu Sasayama
Sumitomo Chemical America, Inc.
345 Park Avenue
New York, NY 10154

Dr. Larry R. Hodges
Union Carbide Corp.
2001 Jefferson Davis Hwy.
Suite 401
Arlington, VA 22202

C. F. Garner
Federal & State Coordinator
Research Product Development
Mobay Chemical Corporation
P.O. Box 4913 - Hawthorn Road
Kansas City, MO 64120

Thomas J. Tatterson
Abbott Laboratories
CAPD..D95M, R1B3
North Chicago, IL 60064

Roy G. Lidstone
Abbott Laboratories Limited
P.O. Box 6150
Montreal, Quebec
CANADA H3C 3K6

Kenneth A. Aldridge
Union Carbide Corporation
1030 St. Andrews Road
Columbia, SC 29210

Sharon A. Ainsworth
Agricultural Products
Company, Inc.
351 E. Eighth Street
North Wales, PA 19454

R. J. Cibulsky
Abbott Laboratories
2826 West Rosegarden Blvd.
Mechanicsburg, PA 17055

Dr. A. Crovetti
Abbott Laboratories
Dept. 986-R1B-3
14th and Sheridan Road
No. Chicago, IL 60064

Wilbur F. Evans
Union Carbide Ag. Products
Co., Inc.
1601 Shepard Drive
Maple Glen, PA 19002

Temple Bowen
Zoecon Corporation
425 Sherman Street
P.O. Box 10975
Palo Alto, CA 94303

Vincent J. Carroll
Bio-Agricultureal Products Group
235 E. 42nd Street
New York, NY 10017

INDUSTRY - continued

Dr. James Curry
Abbott Laboratories
Dept. 928-R1B-3
14th and Sheridan Road
N. Chicago, IL 60064

Agricultural Chemical Research
Agriculture & Veterinary Prod.
Division
Abbott Laboratories
North Chicago, IL 60064

C. R. Freeman
Specialist Products Division
Chevron Chemical Company
940 Hensley Street
Richmond, CA 94804

H. Richard Schneider
Sandoz Inc.
P. O. Box 243, 8048 Lincoln Way
St. Thomas, PA 17252

Dr. Donald A. Spencer
Consulting Economist
National Agric. Chemical Assn.
1155 15th Street, NW
Washington, DC 20005

Mr. Giacomo Williams
Beeco Products
Fort Washington Industrial Park
Fort Washington, PA 19034

J. T. Schmidt
Uniroyal Chemical
32 Spencer Street
Emic Building
Naugatuck, CT 06770

Phillip R. Kolb
Biochemicals Dept.
E.I. Du Pont Company, Inc.
308 East Lancaster Avenue
Wynnewood, PA 19096

INDUSTRY - continued

James L. Bean
Consulting Entomologist
Postal Route 3
Waldoboro, ME 04572

MISCELLANEOUS

Jim Ross
15 Keaney Square
Lowell, MA 01854

Dr. Eugene J. Gerberg
1330 Dillion Heights Avenue
Baltimore, MD 21228

Barbara Lapham
Marion Township
RFD
Dennysville, ME 04628

Charles T. Betush
Gypsy Moth Coordinator
Mifflin County
P.O. Box 276
Burnham, PA 17009

William Land
Brown University
Box 3378
Providence, RI 02912

Eric Rosenthal
c/o M. B. Reynolds & Associates
136 East 57th Street
New York, NY 10022

G. Picard
Box 207A, Rt. 2
Oxford, ME 04270

G. Daniel Dussell
Box 213 Stony Garden Road
Road #1
Kintnersville, PA 18930

Dr. H. Schabel
CNR, UWSP
Stevens Point, WI 54481

St. Regis Mohawk Health Serv.
Community Building
Akwesasne
(Hogansburg), NY 13655
ATTN: James Ransom

Clinton A. Plummer
14 Brookside Avenue
Augusta, ME 04333

Jeanne Christie
31-A Second Street
Presque Isle, ME 04769

Joseph M. Lupsha
P.O. Box 80
Windsor, ME 04363

Frederick N. Bell
88 Forest Street
Saco, ME 04072

Barry C. Fenicle
Mechanicsburg Sportsmen's Assoc.
503 Benyou Lane
New Cumberland, PA 17070

Mr. Gold
203 Hewett Road
Wyncote, PA 19095

Anita M. Kunig
1066 Sussex Tpk.
Randolph, NJ 07869

Charles H. Burchfield, Exec. Asst.
112 Spring Street
Martinsburg, PA 16662

Earl K. Noll, Coord., GM
Union County Courthouse
Second & St. Louis Street
Lewisburg, PA 17837

Derek Anspack
84 Analomink Street
East Stroudsburg, PA 18031

Nicholas Soccente
P.O. Box 370
Dingmans Ferry, PA 18328

Marvin R. Black, Director
110A Benson-East
Jenkintown, PA 19046

David Platt
Bangor Daily News
Bangor, ME 04401

John R. Kline
128 Ninth Avenue
Folsom, PA 19033

MISCELLANEOUS - continued

Otto M. Rothenhausler
17 S. 13th Street
Easton, PA 18042

Dr. Robert W. Guth, Ecologist
RPF Ecological Associates
727 Reba Place
Evanston, Illinois 60202

A. Wayne Cobb
Town of Gloucester
P.O. Box 82
New Gloucester, ME 04260

John B. Roberts
Square Pond Assn.
12 Storer Street
Sanford, ME 04073

Ruth S. Ham
Township of Shapleigh
Selectman
P.O. Box 26, Municipal Bldg.
Shapleigh, ME 04076

Dr. Philip M. Tierno, Jr.
30 Carter Street
Norwood, NJ 07648

Vivian M. Vinci
5 Walter Drive
Bloomingdale, NJ 07403

Pam Adolphus
Common Farms
Route 2, Hinkle Road
Poestenkill, NY 12140

Susan Shaw
Upper Rariton Watershed Assoc.
14 Hathaway Lane
Montville, NJ 07045

Robert G. Struble, Commissioner
Court House
West Chester, PA 19380

Robert Uguccioni, Executive Dir.
1004 Main Street
Pocono Mountains Vacation
Bureau, Inc
Stroudsburg, PA 18360

Barbara Bisconti
2620 Terwood Hill Drive
Willow Grove, PA 19090

Roman B. Spehar
Berks County Cons. District
Agricultural Blvd.
Road #1
Leesport, PA 19533

Dr. Lawrence W. Smith, Jr.
Food Pkg. & Proc. Group
FEL - NARADCOM
Natick, MA 01760

Ken Payne
League of Cities and Towns
128 North Main Street
Providence, RI 02903

Ellen Dietrich
Soil Conservationist
Road #1, Box 363
Leesport, PA 19533

Samuel A. High, Co. GM Coord.
Road #2, St. Peters Road
Pottstown, PA 19464

John P. Kolenda
Lacka County GM Coord.
Box 334 - Road #1, Scott Twp.
Olyphant, PA 18447

M. Douglas McIlroy
Jockey Hollow Road
Bernardsville, NJ 07924

Diane Nelson
R.D. #2, Box 254
Hillcrest Road
Boonton, NJ 07005

T. Doman Roberts
430 Cassatt Road
Berwyn, PA 19313

MISCELLANEOUS - continued

Ralph L. Schmidt
P.O. Box 403
Huntingdon, PA 16652

David C. Shaw, Superintendent
Shade Tree Commission
Holmdel Arboretum
Hall of Records Annex
20 Court Street
Freehold, NJ 07728

Philip E. Tracy, Director
Narragansett Council -
Boy Scouts of America
175 Broad Street
Providence, RI 02903

Joseph Sanzone
Suffolk County Vector Control
P.O. Box 27
Yaphank, NY 11980

Paul I. Twerdowsky
Highlands Watershed Association
1117 Macopin Road
W. Milford, NJ 07480

Doris G. White, Ph.D
William Paterson College
Rm 408, Raubinger Hall
300 Pempton Road
Wayne, NJ 07470

Jane P. Russell, Director
Chester County Conservation
District
P.O. Box 94
Lewisville, PA 19351

Sarah L. Johnston
Ulster County EMC
244 Fair Street
Box 1800
Kingston, NY 12407

American Forestry Association
1319 18th Street, NW
Washington, DC 20014

Fred Huntress, Jr.
New England Forestry Foundation
RFD 1
Poland Springs, ME 04274

MISCELLANEOUS - continued

Robert Libby
Town of Bowdoinham
P.O. Box 85
Bowdoinham, ME 04008

Cathryn Foden
1605 Pelhan Avenue
Havertown, PA 18930

Edward A. Stimely
P.O. Box 276
Burnham, PA 17009

Society of American Foresters
5400 Grovenor Street
Washington, DC 20014

Stephen A. Cywin
12 Pine Terrace
Wayne, NJ 07470

Dr. John P. Field
Star Route, Box 433
Dingman's Ferry, PA 18328

Bricklin & Gendler
Suite 900
Fourth and Pike Building
1424 Fourth Avenue
Seattle, WA 98101

OTHER

W. Bozzo
Possi
850 S. Clearview Parkway
New Orleans, LA 70123

Linda Cadwell
International Paper Company
Suite 700
1620 Eye St., NW
Washington, D.C. 20006

Don Campbell, Superintendent
Harpers Ferry National
Historical Park
P.O. Box 65
Harpers Ferry, WV 25425

Robert Foley
Hale Creek Field Station
7235 Steele Avenue
R.D. 2
Gloversville, NY 12078

Albert Fralinger
Nuclear Department
Public Service Electric & Gas
Company
P.O. Box 236
Hancocks Bridge, NJ 08038

George Gerliczy
Salvoy American Corporation
609 5th Avenue
New York, NY 10017

Norma Grier
Northwest Coalition for
Alternatives to Pesticides
P.O. Box 375
Eugene, OR 97440

John Kennedy
American Bank Building
608 Washington Boulevard
Laurel, MD 20707

Ken Kruse
PPQ, APHIS, USDA
1010 Jorie Boulevard
Suite 36
Oakbrook, IL 60521

OTHER - continued

R.J. LaBar
Hammermill Paper Company
1540 East Lake Road
Erie, PA 16533

George Lobsenz
UPI
Room 2102
Rayburn House Office Building
Washington, D.C. 20515

R.G.M. Markle
National Coordinator, IR-4 Project
New Jersey Agricultural Experiment Station
Cook College
New Brunswick, NJ 08903

Philip Marvin
1730 Skyline Drive
Lincoln, NE 68506

Patrick Meckley
Chief of Resource Protection
Maryland Forest Park & Wildlife Services
580 Taylor Avenue
Annapolis, MD 21401

Helen Moore
4116 Arckelton Drive
Raleigh, NC 27612

John Nelson
Environmental Services Section
2215 W. Old Shakopee Road
Bloomington, MN 55431

Mr. & Mrs. G. Olsen
354 Hrubetz Road, SE
Salem, OR 97302

Ellen Rainer
Racheal Carson Council
8940 Jones Mill Road
Chevy Chase, MD 20815

Daniel F. Read
5707 Waycross Street
Raleigh, NC 27606

OTHER - continued

J. Reynolds
Room 205, Slidell Towers
520 Old Spanish Trail
Slidell, LA 70458

Fred Schmidt
Documents Librarian
Colorado State University Libraries
Fort Collins, CO 80523

Paul Schroeder
Environmental Protection Agency
1921 Jefferson Davis Highway
Crystal City Mall 2
Arlington, VA 22202

ATEN-FN Spencer
Headquarters, U.S. Army
Training and Doctrine Command
Ft. Monroe, VA 23651

Kathleen Thuner
Agricultural Commissioner
San Diego County
5555 Overland, Bldg. 3
San Diego, CA 92123

Dennis Williamson
972 Judson Street, SE
Salem, OR 97302

Suzanne McGuire
Environmental Health Centre
Room B43
Tunney's Pasture
Ottawa, Ontario
KIA OL2

Paul L. Boley Law Library
The Lewis and Clark Law School
Northwestern School of Law
10015 SW Terwilliger Boulevard
Portland, OR 97219

APPENDIX C

REVIEW OF EXPERIMENTAL EVIDENCE ON THE MUTAGENICITY OF N-NITROSOCARBARYL

Retyped verbatim from the Carbaryl Decision Document,
December 1980.
U.S. Environmental Protection Agency

REVIEW OF EXPERIMENTAL EVIDENCE ON THE MUTAGENICITY OF N-NITROSOCARBARYL

Carbaryl has been shown in vitro to react with sodium nitrite under acidic conditions (pH 1) to form N-nitrosocarbaryl (Eisenbrand et al., 1974). Because nitrite is present in human saliva and food products, the formation of nitrosocarbaryl in stomach physiology is possible, in view of the widespread use of carbaryl. Rickard (1979) demonstrated the in vitro formation of nitrosocarbaryl in the stomach of rats and guinea pigs. When guinea pigs were given either simultaneous intubation of carbaryl (1 umol) and sodium nitrite (1160 umol), or when these components were mixed with feed, approximately a 1.5 percent yield of nitrosocarbaryl was detected. The formation of this nitroso derivative was dependent on the amount of nitrite and the pH, and not particularly by the amount of carbaryl present. Increasing the amount of carbaryl from 0.025 to 2.5 umol did not increase the yield of the nitroso compound. In rats, the stomach pH (3.5-5.5) is higher than in guinea pigs (pH 1.5), and in that species a very low yield of nitrosocarbaryl was found (0.02 percent) at the same concentrations of nitrite and carbaryl.

Nitrosocarbaryl has been shown to be strongly mutagenic in bacteria. Blevins et al. (1977) found that the base-pair substitution sensitive Salmonella strains TA 100 and TA 1535 were reverted by this without metabolic activation. The reversion frequency in TA 100 was increased by approximately 1.6-fold at 1.15 ug/plate and 6-fold at 11.5 ug/plate, and TA 1535 by about 3-fold at 76-fold at 11.5 ug/plate. Nitrosocarbaryl was not as active on the frameshift sensitive strains TA 98, TA 1537, and TA 1538. Marshall et al. (1976) found that nitrosocarbaryl increased the number of histidine-independent colonies of TA 1535 by approximately 6-fold at 0.5 ug/plate and by 367-fold at 50 ug/plate without metabolic activation. Marshall et al. also found nitrosocarbaryl to be slightly active (above 6-fold over background values) on the frameshift sensitive strains TA 1537 and TA 1538 at 50 ug/plate. Both Blevins et al. (1977) and Marshall et al. (1976) found that the mutagenic activity of nitrosocarbaryl was dose-related.

Elespuru and coworkers (1974) measured the induction to novobiocin resistance in Haemophilus influenzae. These authors found that nitrosocarbaryl was approximately an order of magnitude more potent than the mutagen N-methyl-N'-nitrosoguanidine (MNNG). In Escherichia coli nitrosocarbaryl was also more potent in the induction to arginine prototrophy than MNNG (Elespuru et al., 1974). Uchiyama et al. (1975) found mutagenic activity as tested by the ability to cause reversion at the tryptophan locus in Escherichia coli (data not quantitated).

Generally, metabolic activation was not required for the mutagenic response of nitrosocarbaryl. For example, when Marshall et al. (1977) incorporated the S-9 fraction in the Salmonella assay, a decrease in mutagenic activity was observed. Greim et al. (1977), however, found an increase in mutagenicity after metabolic activation by mouse-liver microsomes.

Siebert and Eisenbrand (1974) reported that nitrosocarbaryl was active in causing mitotic gene conversion in *Saccaharomyces cerevisiae*. Incubation for 2 hours on 1 ppm of nitrosocarbaryl increased the relative conversion frequency 3-fold for the *ade*-2 locus and 5-fold for the *trp*-5 locus, and at 30 ppm increases were 139-fold for the *ade*-2 locus and 885-fold for the *trp*-5 locus. In this study, a dose-related effect was shown using 5 concentrations of nitrosocarbaryl. Regan et al. (1976) demonstrated that nitrosocarbaryl was able to induce DNA damage in culture human cells as measured by unscheduled DNA synthesis. In addition, by using methyl labeled [^{14}C] and ring labeled [^{3}H] nitrosocarbaryl, Regan et al. (1976) found that the ^{14}C label was associated with cellular DNA, whereas the ^{3}H label was not. Because nitrosocarbaryl has been observed to cause reversion of base-pair substitution sensitive strains (TA 100, TA 1535), these results suggest that the nitrosocarbaryl molecule was split and the resultant methyl group could alkylate DNA and cause base-pair substitution type mutations.

Ishidate and Odashima (1977) reported several chromosome aberrations (80 percent aberrant cells) in Chinese hamster cells 24 hours after exposure to nitrosocarbaryl (0.015 mg/ml). The toxicity of nitrosocarbaryl was not reported.

APPENDIX D

EPA CARBARYL DECISION DOCUMENT, DECEMBER 1980: SUMMARY OF CONCLUSIONS

CARBARYL DECISION DOCUMENT, DECEMBER 1980
Office of Pesticides & Toxic Substances
Environmental Protection Agency
401 M Street SW
Washington, DC 20460

A. Summary of Conclusions*

1. Teratogenic and Fetotoxic Effects. Based on the weight of evidence of currently available studies which are valid and interpretable, the Agency has concluded that a rebuttable presumption on the basis of carbaryl-related teratogenic and fetotoxic effects is not warranted at this time. In the Agency's judgment, the extremely high doses of carbaryl used to elicit effects in the developing organism, coupled with the positive correlation of maternal and fetal toxicity in the multiple species tested (the dog being a possible exception), do not indicate that the pesticide carbaryl constitutes a potential human teratogenic or reproductive hazard under proper environmental usage. However, the Agency is considering whether another study in dogs should be conducted, with special attention paid to sufficient numbers of animals in the dose groups, the condition of the bitches throughout the period of dosing, and maternal and fetal blood levels of the compound.

2. Mutagenic Effects. Based on the weight of extensive existing evidence, the Agency has determined that the current data base does not support a conclusion that carbaryl poses a mutagenic hazard to humans. Due to the weak mutagenic responses which have measured, and due to the suggestive rather than conclusive nature of the evidence available as to the potential of carbaryl to reach the mammalian germinal tissues, the Agency believes that general exposure-reduction measures typical of those already on many of the labels, are appropriate and will be pursued prior to any further RPAR review. A rebuttable presumption on the basis of carbaryl-related mutagenic effects is therefore not warranted at this time.

3. Oncogenic Effects. Based on the weight of existing evidence, the Agency has concluded that the current data base does not indicate that carbaryl poses on oncogenic hazard to humans. A rebuttable presumption on the basis of carbaryl-related oncogenic effects is therefore not warranted at this time.

4. Neurotoxicity. Based on available evidence, the Agency has concluded that carbaryl does not pose a human health hazard in terms of neurotoxic effects. A rebuttable presumption on the basis of neurotoxicity is therefore not warranted at this time.

---

* From: With oral approval from EPA, retyped verbatim in order to produce a clear copy.

5. Viral Enhancement. The Agency's determination at this juncture is that research into viral enhancement as a possible adverse effect of exposure to carbaryl is preliminary in nature and that current information does not constitute a basis on which to conclude that carbaryl poses a human hazard in this area. A rebuttable presumption on the basis of viral enhancement is therefore not warranted at this time.

6. Overview--Determining Considerations. Recognizing that the data base on any chemical is necessarily a continuum, the Agency's determination not to proceed with an RPAR action against carbaryl at this time takes into account a number of considerations in connection with the present toxicological picture of the pesticide. As has been pointed out, the current data base under review is extensive, more extensive than has ordinarily been the case for pesticides which have come under Agency review. This is particularly true for teratogenicity/fetotoxicity and mutagenicity, which are the toxicological areas of primary concern, and it is unlikely that resource-intensive RPAR procedures would surface data not already in the Agency's possession via other channels.

Although the current data base is extensive, risk data are not unequivocal, and study results, again in the areas of teratogenicity/fetotoxicity and mutagenicity, have been inconsistent. The current toxicological picture of carbaryl thus reflects a degree of uncertainty. It is in the face of such uncertainty that the Agency must determine whether or not to proceed with an RPAR action and the detailed risk/benefit analysis the RPAR process is intended to implement. In the case of carbaryl, consideration of the overall weight of current evidence leads the Agency to conclude that the responsible call is not to initiate RPAR proceedings at this juncture but rather to address the concerns at issue via the recommendations made below. Should further review data indicate that current use patterns of the pesticide pose unreasonable adverse effects to human health or the environment, however, the Agency will re-open the case of carbaryl as an RPAR candidate.

B. Recommendations

Because the Agency has concluded that a rebuttable presumption against registration and continued registration of pesticide products containing carbaryl is not warranted at this time, the Agency's recommendation is that carbaryl be returned to the registration process. This recommendation is made with the following stipulations: 1) that a FIFRA sec. 3(c) (2) (B) action be considered for additional data on the effects of carbaryl, possible including another study of the teratogenic and fetotoxic effects of carbaryl in dogs 2) that appropriate label changes be implemented according the forthcoming negotiations between the Agency and registrants to ensure that exposure is minimized.

APPENDIX E

HISTORY OF GYPSY MOTH ERADICATION

Appendix E
History of Gypsy Moth Eradication

Location	Year of Initial Treatment	Approximate Acreage	Treatment (Number of Applications)	Status	Remarks
Calhoun County, MI (Duck Lake)	1967	15,000	carbaryl (2)	Eradicated	Remains uninfested.
Jefferson County, PA	1972	625	carbaryl (2)	Eradicated	Overrun by natural spread.
Isabella County, MI	1973	14,386	carbaryl (2)	Infested	Center of developmental activities in '74 & '75. Eradication abandoned '76.
Lorain County, OH	1973	300	trichlorfon (2)	Eradicated	Remains uninfested.
Smyth County, VA	1974	1,000	carbaryl (2)	Eradicated	Remains uninfested.
Forsyth County, NC	1974	640	carbaryl (2)	Eradicated	Remains uninfested.
Monroe County, NY	1974	440	carbaryl (2)	Eradicated	Overrun by natural spread.
Macomb County, MI	1975	500	carbaryl (2)	Eradicated	Overrun by natural spread.
Cook County, IL (Palos Park)	1976	1,000	carbaryl (2)	Eradicated	Remains uninfested.
Outagamie County, WI (Appleton)	1976	40	trapping	Eradicated	Remains uninfested.
Berrien County, MI (Hager Twp.)	1977	2,750	Dimilin (2)	Eradicated	Area just outside treatment block used in '81 for sterile release project.
Washtenaw County, MI (Lodi & Pittsfield Twps.)	1977	3,500	Dimilin (2)	Eradicated	Overrun by natural spread.
Santa Clara County, CA (San Jose)	1977	2,554	Dimilin (2)	Eradicated	Remains uninfested.
Avery County, NC	1979	724	Dimilin (2)	Eradicated	Remains uninfested.
Clark & Loudon Counties, VA and Jefferson County, WV	1979	8,582	Dimilin (2)	Eradicated	No moths trapped '80 & '81 Overrun by natural spread.
King County, WA (Renton)	1979	400	acephate (2)	Eradicated	Remains uninfested.
Waukesha County, WI	1979	337	Gypcheck (2)	Infested	
" "	"	420	Disparlure		
" "	1981	100	Disparlure	Infested	17 moths in '83.
" "	"	425	mass trapping	Infested	14 larvae in '81.
" "	"	10	carbaryl	Infested	64 larvae in '81.
" "	1982	425	mass trapping	Infested	19 moths in '82.
" "	1983	300	mass trapping	Infested	4 moths in '83.
Montgomery County, OH (Kettering)	1980	340	trichlorfon (2)	Eradicated	Remains uninfested.
Ottawa County, OH (Catawba Island)	1980	200	trichlorfon (2)	Infested	2 moths trapped in '81.
" " " "	1982	84	carbaryl (2)	Eradicated	Remains uninfested.
Calhoun County, MI (Battle Creek Twp.)	1980	1,000	carbaryl (2)	Eradicated	Remains uninfested.
Van Buren County, MI (Pine Grove Twp.)	1980	460	carbaryl (2)	Eradicated	Remains uninfested.
McHenry County, IL (McHenry)	1980	40	B.t. (2)		
" " "	"	300	mass trapping		
McHenry County, IL (McHenry)	1981	100	B.t. (2)		
" " "	"	300	mass trapping	Eradicated	No moths trapped in '81-82
Lake County, IL (Kildeer)	1980	30	carbaryl (2)	Eradicated	No moths trapped in '81-82

Floyd County, VA	1980	3,055	Dimilin (2)	Eradicated	11 moths trapped in '80.
" " "	"	50	B.t. (2)	"	B.t. used around lake of same block.
" " "	1981	1,315	Dimilin (2)	Infested	1 moth trapped in treatment block.
" " "	1982	4,632	Dimilin (2)	Infested	5 moths trapped in treatment block in '82.
Lunenburg County, VA	1981	213	Dimilin	Infested	5 moths trapped in '81.
" " "	"	20	carbaryl		
" " "	1982	300	Dimilin (2)	Eradicated	No moths trapped in '82.
Lake County, IL (Diamond Lake)	1981	3	carbaryl (2)	Eradicated	No moths trapped in '81-82
Lake County, IL (Lincolnshire)	1981	35	carbaryl (2)	Eradicated	Remains uninfested.
DuPage County, IL (Wheaton)	1981	50	carbaryl (2)	Infested	Area had not been delimited.
" " " "	1982	300	B.t. (2)	Infested	103 moths trapped in
" " " "	"	300	mass trapping		treatment block in '82.
" " " "	1983	230	B.t. (2)	Infested	5 moths trapped in '83.
" " " "	"	800	mass trapping		
Oakland County, MI (Bloomfield Twp.)	1981	552	carbaryl (2)	Eradicated	Overrun by natural spread.
Wayne County, MI (Livonia Twp.)	1981	316	carbaryl (2)	Eradicated	Overrun by natural spread.
Kalamazoo County, MI (Cooper Twp.)	1981	643	carbaryl (2)	Eradicated	Remains uninfested.
Kent County, MI (Caledonia Twp.)	1981	530	B.t. (2)		
" " " "	1981	500	disparlure	Infested	
" " " "	1982	517	carbaryl (2)	Eradicated	Remains uninfested.
Berrien County, MI	1981	400	sterile males		No native moths trapped
" " " "	1982	400	sterile males	Eradicated	in '82 & '83.
Stark County, OH (Lake Twp.)	1981	355	carbaryl (2)	Eradicated	Remains uninfested.
Marion County, OR (Salem)	1981	20	acephate (2)	Eradicated	Remains uninfested.
Orange County, CA	1981	10	carbaryl (3)	Eradicated	Remains uninfested.
Lancaster County, NE	1981	1,000	traps/carbaryl		
" " " "	1982	600	mass trapping	Eradicated	Remains uninfested.
King County, WA (Lincoln Pk., Ravenna Pk. and Mercer Island)	1981	840	B.t. & trapping	Infested	236 moths in '81.
Clark County, WA	1981	20	carbaryl	Infested	Moths on edge of treatment block.
" " "	1982	120	acephate (2)	Infested	
" " "	1983	360	B.t. (3)	Eradicated	
Marion County, OR (Salem)	1982	3,976	carbaryl (2)	Infested	7 moths trapped in '82. 1 moth trapped in '83.
McHenry County, IL (Crystal Lake)	1982	100	carbaryl (2)	Eradicated	Remains uninfested.
Lake County, IL (Lake Zurich)	1982	80	carbaryl (1)	Eradicated	Remains uninfested.
Lake County, IL (Lindenhurst)	1982	50	carbaryl (2)	Eradicated	" "
Lake County, IL (Lake Forest)	1982	10	carbaryl (2)	Eradicated	"
Tazewell County, IL (Morton)	1982	5	carbaryl (2)	Eradicated	" "
Vigo County, IN (Terre Haute)	1982	500	carbaryl (2)	Eradicated	" "
Grand Traverse County, MI (Peninsula Twp.)	1982	728	carbaryl (2)	Eradicated	" "
Muskegon County, MI (Roosevelt Park)	1982	653	carbaryl (2)	Eradicated	" "

Ottawa County, MI (Grand Haven Twp.)	1982	550	carbaryl (2)	Eradicated	Remains Infested
Belmont County, OH (Barkcamp State Park)	1982	120	carbaryl (2)	Eradicated	" "
Hamilton County OH (Anderson Twp.)	1982	146	carbaryl (2)	Eradicated	" "
Hamilton County, OH (Paul Meadows)	1982	38	carbaryl (2)	Eradicated	" "
Hamilton County, OH Montgomery)	1982	38	carbaryl (2)	Eradicated	" "
Cuyahoga County, OH (Solon)	1982	54	carbaryl (2)	Eradicated	" "
Cuyahoga County, OH (Pepper Pike)	1982	87	carbaryl (2)	Eradicated	" "
Cuyahoga County, OH (Bay Village)	1982	38	carbaryl (2)	Eradicated	" "
Tuscarawas County, OH (Newcomertown)	1982	93	carbaryl (2)	Eradicated	" "
Stark County, OH (Uniontown)	1982	58	carbaryl (2)	Eradicated	" "
Portage County, OH (Freedom Twp.)	1982	57	carbaryl (2)	Eradicated	" "
Lucas County, OH (Ottawa Hills)	1982	213	carbaryl (2)	Eradicated	" "
Johnson County, NC (Selma-KOA CG)	1982	100	Dimilin (2)	Eradicated	" "
Wake County, NC (Raleigh)	1982	225	B.t. (2)	Eradicated	" "
Fulton & Sharp Counties, AK (Hardy)	1982	1,526	carbaryl (2)	Eradicated	" "
Mobile County, AL	1982	5	carbaryl (2)	Eradicated	" "
Santa Barbara County, CA	1982	9,600	B.t.	Eradicated	" "
" " " "	1982	600	carbaryl		
Horry County, SC (Windjammer Village)	1982	100	sterile males	--	Under evaluation.
Dane County, WI (Monona)	1982	300	mass trapping	Infested	114 moths trapped in '82.
" " "	1983	300	" "	Infested	40 moths trapped in '83.
Alameda County, CA (Pleasanton)	1983	160	carbaryl (3)	Eradicated	
Contra Costa County, CA (Clayton)	1983	64	carbaryl (3)	Eradicated	
Los Angelos County, CA (Westlake Village)	1983	100	carbaryl (3)	Eradicated	
Marin County, CA (Novato)	1983	10	carbaryl (3)	Eradicated	
San Mateo County, CA (Fair Oaks)	1983	40	carbaryl (3)	Eradicated	
San Mateo County, CA (San Mateo)	1983	50	carbaryl (3)	Eradicated	
Santa Clara County, CA (Campbell)	1983	160	carbaryl (3)	Eradicated	
Santa Clara County, CA (Palo Alto)	1983	160	carbaryl (3)	Eradicated	
Santa Clara County, CA (Los Altos)	1983	200	carbaryl (3)	Eradicated	
DuPage County, IL (Downers Grove)	1982	800	B.t. (2)	Infested	
" " " "	1983	50	B.t. (2)	"	1 moth trapped in
" " " "	1983	367	mass trapping		treatment blocks in '83.
DuPage County, IL (Naperville)	1982	60	B.t. (2)		
" " " "	1983	40	B.t. (2)	Eradicated	No moths trapped in
" " " "	1983	200	mass trapping		treatment blocks in '83.
DuPage County, IL (Wood Dale/Personville)	1982	500	B.t. (2)		
" " " " "	1983	989	B.t. (2)	Infested	13 moths trapped in treatment blocks in '83.
" " " " "	1983	1,532	mass trapping		
Kane County, IL (St. Charles)	1983	90	B.t. (3)	Infested	1 moth trapped in treatment block in '83
Elkhart County, IN (Goshen) "	1983	80	carbaryl (2)	Eradicated	Only 80 acres of 300 acre treated. Moths trapped on periphery of area.

Kalamazoo County, MI (Portage Twp.)	1983	800	carbaryl (2)	Eradicated	No moths trapped in '83.
Muskegon County, MI (Norton Shores Twp.)	1983	160	carbaryl (2)	Eradicated	" " " " "
Van Buren County, MI (Antwerp Twp.)	1983	400	carbaryl (2)	Eradicated	" " " " "
Ramsey County, MN (St. Paul)	1983	300	carbaryl (2)	Eradicated	No moths trapped in treatment area in '83.
Washington County, MN (Woodbury)	1983	130	carbaryl (2)	Eradicated	" " "
Carteret County, NC (Beaufort)	1983	170	disparlure	--	Evaluate in 1984.
Franklin County, OH (Blacklick)	1983	120	carbaryl (2)	Eradicated	No moths trapped in '83.
Franklin County, OH (Jefferson Twp.)	1983	80	carbaryl (2)	Eradicated	" " "
Hamilton County, OH (Cincinnati)	1983	105	carbaryl (2)	Eradicated	" " "
Hamilton County, OH (Anderson Twp.)	1983	130	carbaryl (2)	Eradicated	" " "
Knox County, OH (Mt. Vernon)	1983	65	carbaryl (2)	Eradicated	" " "
Lucas County, OH (Sylvania Twp.)	1983	160	carbaryl (2)	Infested	
Marion County, OR (Salem)	1983	50	carbaryl (2)	Infested	No moths trapped in '83.
Jasper County, OH (Americana CG)	1983	40	carbaryl (3)	Eradicated	No moths trapped in '83.
Horry County, SC (Ocean Lakes CG)	1983	100	carbaryl (3)	Infested	49 moths trapped in '83.
Floyd County, VA (Tuggles Gap)	1983	4,001	disparlure		No moths trapped in treatment block or entire county in '83. Evaluate in '84.
King County, WA (Ravenna Park)	1983	1,040	B.t. (2) & mass trapping	Infested	32 moths trapped in '83.
Pierce County, WA (Takoma East)	1983	800	B.t. (2) & mass trapping	Infested	5 moths trapped in '83.
Pierce County, WA (Takoma West)	1983	320	B.t. (2) & mass trapping	Infested	33 moths trapped in '83.
Waukesha County, WI (Elm Grove)	1983	60	B.t. (2) & mass trapping	Infested	3 moths trapped in '83.

APPENDIX F

ANALYSIS OF HUMAN HEALTH RISKS OF USING ACEPHATE, CARBARYL, DIFLUBENZURON, AND TRICHLORFON INSECTICIDES IN GYPSY MOTH SUPPRESSION AND ERADICATION PROJECTS

ANALYSIS OF HUMAN HEALTH RISKS OF USING ACEPHATE, CARBARYL, DIFLUBENZURON, AND TRICHLORFON INSECTICIDES IN GYPSY MOTH SUPPRESSION AND ERADICATION PROJECTS

PURPOSE AND SCOPE

The purpose of this risk analysis, using worst case assumptions where appropriate according to the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508), is to provide decisionmakers and the public with an estimation of the human health risks of using chemical insecticides for suppression and eradication of gypsy moth. The analysis addresses the attendant risks of spraying on an operational basis as well as considering abnormal situations and accidents which might provide short term, but larger exposures than from normal operations. The abnormal and accident situations can be minimized by mitigation, but estimates of frequency of occurrence based upon historic experience as well as postulated scenarios, are used in these worst case assumptions.

Human health risks to the general public in areas to be treated and those in nearby areas have been estimated for all cases. Occupational exposures to mixer/loaders, and observers are also determined, but are shown as separate populations from to the general public.

This analysis provides the best estimate of the potential risks that can be postulated from available information. When necessary information was not available, several approaches were used:

1. If the information could be found at reasonable cost and in time for the analysis, such information was acquired.

2. If the information could not be obtained because it is beyond measurement capability, worst case assumptions were used to provide a most conservative risk estimate; i.e., the highest estimate of risk that could possibly occur under real situations.

3. If the information could be obtained within the timeframe of this analysis, but the costs of acquiring it were exorbitant, worst case assumptions similar to paragraph 2 above were used. In judging whether the cost of obtaining data was exorbitant, several criteria were used:

   a. All of the costs for obtaining all the data needed had to be considered, not just the incremental cost of a single set of data, which would be of little use without the full data set.

   b. On an incremental basis, the cost of acquiring the data versus its criticality to the analysis was also taken into account. Proportionally more could be spent for critical items than for others in which a worst case assumption would only affect the analysis minimally. However, if critical data, e.g., carcinogenic potency slope of

nitrosocarbaryl and trichlorfon could not be obtained because of measurement limitations, the importance of other information which might be available, but less critical, diminishes; i.e., the uncertainty in critical parameters is more important than the uncertainty in less critical ones.

c. If costs of data acquisition were in the same order of magnitude or larger than the cost of the program, these costs would be considered exorbitant on an absolute basis.

When worst case assumptions are used, the rationale for use of the assumption, and the basis for the worst case estimate as well as more realistic estimates, are provided. In using worst case assumptions in place of more realistic estimates, the analysis will, nevertheless, provide decisionmakers and other readers with adequate information to make rational choices among the alternatives.

RATIONALE FOR THE RISK ANALYSIS

This risk analysis, using realistic data points and worst case assumptions, is based on both eradication and suppression project scenarios in urban, suburban, and rural areas covering a period of 70 years, the average lifetime of exposed individuals. The normal operational project for a single application of each chemical insecticide for eradication and for suppression, provides a base case for each alternative chemical (based on a 1 lb active ingredient (a.i.)/acre application). This provides a basic estimate of the amount of chemical per acre (base case dose) which could occur from the proposed project.

Next, the frequency of applications over a 70-year lifetime is calculated for each project (a maximum of 10 applications for suppression and a maximum of 6 applications for eradication) to determine the maximum lifetime insecticide exposure to all possible recipients. The maximum exposure from actual applications is determined by taking into account extreme ranges of normal mixing and application errors to extend the base case dose to include these errors. This provides a conservative estimate in that the extremes of the error range are assumed to occur under all conditions. This conservative estimate is referred to, in this analysis, as the realistic dose.

Abnormal scenarios take into account such possible variations as more than the scheduled number of applications to an area, use of other insecticides than intended, wrong area treated, etc. These are treated as increases in the basic amount applied (including normal mixing and application errors), but with an estimated probability of occurrence. These estimates are referred to as worst case doses. Airplane and truck accidents are also treated in this manner, but the target population is much smaller and the exposure pathways different.

The base case dose provides the basis for estimation of exposures to people by inhalation, ingestion, and dermal pathways. The inhalation pathway includes both direct application and drift downwind and resuspension due to volatilization where applicable. The ingestion pathway includes water and food, the latter taking into account consumption of animals, fish, fruits, and vegetables. The dermal pathway includes direct application and exposure to spray residues after application. Each pathway results in a dose to the maximum exposed individual (MEI). This hypothetical individual weighs 70 kg (a generally accepted figure for an adult male) and lives 70 years on the site of highest exposure. The sum of all pathways provides the estimate of the maximum dose. When possible, average exposure has been estimated, to provide a more realistic estimate in addition to the maximum exposed individual (MEI). The base case dose is multiplied by operational errors and number of applications to obtain the worst case lifetime dose for normal operation. Similar multipliers are used for abnormal conditions. Separate analyses are used for accidents since the exposure pathways are different.

The toxicity of each chemical has been reviewed. The LD_{50} dose for acute exposures and no observable effect levels (NOEL's), acceptable daily intake (ADI), and threshold limit values (TLV), have been obtained or estimated and used for all chronic exposures, except for carcinogenicity. In this case, there is some, but inconclusive evidence that N-nitrosocarbaryl, a metabolic derivative of carbaryl, poses a carcinogenic risk to humans, and that trichlorfon is mutagenic in experimental animals and therefore a suspected carcinogen. Potency-slope values for these substances are not directly available, so conservative potency factors were calculated from available published information.

The result of the exposure analysis is a set of maximum lifetime doses to individuals for the range of scenarios. These doses are compared to NOEL's, ADI's, and TLV's to provide a measure of impact. In addition, cancer probabilities are calculated for nitrosocarbaryl and trichlorfon on the basis of assuming there may be some risk from the most minimum level of exposure.

RISK ANALYSIS USING WORST CASE ASSUMPTIONS

This risk analysis uses worst case assumptions in the absence of information that could not be obtained for the analysis. These worst case assumptions deal with scenarios that can realistically occur or have happened in the past in gypsy moth suppression and eradication projects. As such, this analysis is the type of worst case analysis described in CEQ regulations (40 CFR 1502.22). An attempt was made to be more precise in the description of the analysis than simply calling it a worst case analysis.

The risk analysis presented follows the outline below:

1. Frequency of Exposure During a Lifetime

2. Amount of Material Deposited per Application for the Base, Realistic, and Worst Case Situations

3. Exposure Scenario Development

   A. General Assumptions for the Base Case Exposures and Estimated Dose Levels

   B. Human Exposures and Estimated Dose Levels

   C. Animal Exposures and Estimated Dose Levels

   D. Environmental Exposure to Humans and Estimated Dose Levels

   E. Summary of Exposures for the Base Case

   F. Accidental Exposures

4. Review of Toxicological Studies

   A. Review of Available Data

   B. Determination of LD_{50}, NOEL's, ADI, and Carcinogenic potency slope.

5. Populations at Risk

6. Exposure Summaries and Determination of Human Health Impact

   A. General Populations and Workers

   B. Sensitive Populations

   C. Assessment of Cancer Risk

      N-nitrosocarbaryl
      Trichlorfon

7. Summary and Conclusions

FREQUENCY OF EXPOSURE DURING A LIFETIME

In order to estimate the probability of long-term health effects, it is necessary to estimate the frequency or the number of times that an individual could be exposed to insecticides used in suppression or eradication projects over a lifetime. This requires estimates of: 1) an average life span; 2) the number of times that a suppression or eradication project could take place on the same area

in a lifetime; and 3) the number of applications of insecticides and hence the number of possible exposures to an individual over a lifetime.

The average life span for humans was assumed to be 70 years, and these people are hypothesized to live in worst case exposure conditions over the 70 years. Estimates of the number of suppression or eradication projects that could occur over the 70-year lifetime of an individual require several assumptions that recognize the difference in objectives as well as geography between the two types of projects. Assumptions used and rationales for their use are described below.

Gypsy moth eradication projects are conducted in areas of the country where infestations have been established by artificial means (i.e., household moves, campers, etc.) as opposed to natural spread. For the purpose of this analysis, it is assumed that only eradication projects will be conducted in these areas over a 70-year period. It is also possible that future applications during the 70-year period may involve implementation of other techniques besides or in place of chemical insecticides. Therefore, frequencies were calculated for the chemical insecticides as a group; the worst case assumption being that during the 70-year period an individual(s) will be exposed to only chemical insecticides in eradication projects.

Suppression projects are usually conducted only in areas of the country where gypsy moth is firmly established, spreading naturally and exhibiting normal cyclic outbreaks. For this analysis, the basic assumptions were similar to those described above. Only suppression activities will be conducted in the area over a 70-year period, and generation of the exposure frequencies will be based upon use of chemical insecticides.

Up to 3 applications of chemical insecticides may be applied over a 6-week period in order to achieve eradication goals. It is probable that the insect could be artificially re-introduced in the same area one more time in a 70-year period. Therefore, the frequency of exposure to an individual from chemical insecticides over a 70-year lifetime is estimated as follows:

3 exposures/project x 2 projects/lifetime =
6 exposures/lifetime

Where chemical insecticides are used in suppression projects, there is one application per project. It is estimated that on the average, over a 70-year lifetime, a suppression project could be conducted in the same area every 7 years or 10 per lifetime. The frequency of exposure to an individual from chemical insecticides over a 70-year lifetime is estimated as follows:

1 exposure/project x 10 projects/lifetime =
10 exposures/lifetime

An exposure event in a lifetime includes both exposure from the direct application and secondary exposure or contact with spray residues on grass, foliage, cars, etc., or eating or drinking contaminated foods.

The generated exposure frequencies take in account the worst case for a wide range of variation, including the possibility of a second application the following year and the case in which there is only 1 treatment in the lifetime of an individual.

AMOUNT OF MATERIAL DEPOSITED PER APPLICATION FOR THE BASE, REALISTIC, AND WORST CASE SITUATIONS

The amount of insecticide (base case) actually applied to an area is subject to normal and abnormal variations that may occur during the mixing and application phases. The normal variations account for minor changes (+ or -) in the actual dose rates applied and are common to all pesticide applications whether it be aerial or ground applications, or application of pesticides around the home. These normal variations are used as a conservative estimate in that the extremes highest levels of the error range are assumed to occur under all conditions. For the purpose of this analysis, a realistic dose rate that accounts for dose increases due to normal variations is used.

The major sources of normal mixing and application variations are:

1. Quality control in insecticides manufacture.
2. Errors of measurement during mixing.
3. Excessive swath overlap during application.
4. Improper aircraft calibration.
5. Drift off target.

The actual amount of active ingredient in a chemical insecticide formulation may vary from the label by ±4 percent according to EPA regulations. Consequently, in actual use situations up to 4 percent more insecticide could unknowingly be applied. It is just as likely that up to 4 percent less insecticide could unknowningly be applied. The probability of occurrence for these situations is unknown. Other normal variations take place during the field mixing phase and result from minor calibration variations in meters used to measure amounts of insecticide or the diluting agents.

Excessive spray swath overlap, skips between swaths, and drift off target may occur, but all except the first one will result in <u>less</u> insecticide actually being deposited in the target area. The assumption in this assessment that the insecticide is completely and evenly distributed over the target area takes into account these minor variations. Improper aircraft calibration can result in either more or less insecticide being applied over the target area. Standard procedures implemented on projects call for recalibration of aircraft if application rates exceed ±5 percent. Consequently, up to 5 percent more material could be applied to an area under

normal operational conditions. A conservative estimate for the extremes of the error range attributable to all normal operational variations is therefore assumed to be ±10 percent. Extremes in quality control measurement and aircraft calibration errors would all have to occur simultaneously in the worst case to reach this level; rather improbable, but possible. For this assessment, a conservative assumption was made that up to 10 percent more insecticide than planned could actually be applied. The realistic dose used in the assessment is, therefore: 1.1 x base case dose.

Abnormal variations can account for major differences (+ or -) in the actual dose rates applied. The probability of occurrence of abnormal variations can be lowered by implementing mitigating measures. For the purpose of this analysis, abnormal variations are treated as an increase in the realistic dose applied, and are presented as a worst case dose, but with an estimated probability of occurrence. Aircraft and truck accidents that result in insecticide spills are also treated in a similar manner, but are adjusted as special cases.

Abnormal operational variations evaluated include:

1. Use of an insecticide not scheduled for a particular area.
2. Treatment of an area not scheduled for treatment.
3. More than the scheduled number of applications to an area.
4. Major errors in mixing.

For variations #1 and #2, the worst case assumption is that a single dose of material would be applied. Therefore, the dose received would be the estimated realistic dose (base case x 1.1).

For variation #3, it is assumed that a double application is made to an area scheduled to receive only one. A dose multiplier of 2, however, is extremely conservative and probably unrealistic. Based upon past studies, the highest insecticide recovery rate recorded in an open area was 60 percent (Orchard et al. 1974). In actual spray blocks, 20 percent to 50 percent is the normal recovery rate range on ground sampling devices (Maksymiuk and Orchard 1975 and Neisess et al. 1976). For this part of the analysis, a 75-percent recovery rate is used. The worst case dose is therefore calculated by multiplying by 2 applications to arrive at a dose which is 1.5 times the realistic dose. The realistic dose has already assumed a 100 percent recovery factor and multiple conservations are unrealistic. Major mixing errors (#4) are possible. A realistic occurrence is one in which 2 times the amount of insecticide is mixed in the batch tank. For reasons similar to #3, i.e., a 75-percent deposition rate, a 1.5 multiplier applied to the realistic dose level is used to develop the worst case dose.

The probability of these abnormal occurrences can be calculated from historic data and models. Probabilities based upon historic data reflects mitigating measures implemented in the past and does not consider new means to mitigate, particularly technological advances, that could be implemented in the future. Therefore, the probabilities used are considered to be very conservative estimates.

The occurrence of abnormal operational variations can be minimized and even eliminated by implementation of effective mitigating measures. Variations occur as a result of human error on the part of applicators and mixing personnel, and can be minimized through implementation of a strong project organization. Specific measures commonly employed on gypsy moth projects include: 1) project monitors who watch the spray planes and communicate with pilots and airport supervisor, 2) loading supervisors who oversee mixing procedures and maintain loading records, and 3) project supervisors who debrief the applicators on a daily basis and orient pilots and other project personnel prior to the next day's work.

Past gypsy moth project data provide an excellent basis for calculating the probability of abnormal variations occurring. The occurrence of variation #1 is nonexistent if only one insecticide is used. This is generally the case in eradication projects conducted in populated areas. The greatest probability of occurrence is where: 1) three or more insecticides are used during a project, 2)all are being used to treat the same type of area (e.g., residential areas), or all are being used to treat areas in close proximity to one another, and 3) mixing and loading of all three are done at a single location by the same contractor. The gypsy moth project records for the Maryland and New Jersey Departments of Agriculture in 1982 and 1983 were used to calculate probability of occurrence as the conditions of their projects closely match those outlined above. Assuming that the average aircraft can treat 300 acres per load, a total of 1,128 individual aircraft loads were required to treat 338,500 acres (1982-1983 project acreage). There were no recorded incidents of variation #1 in either State.

Incident reports from gypsy moth projects reported to the Forest Service Washington Office for the 5-year period 1979-1983 indicate that there were only 3 reported cases where an area not scheduled for treatment was actually treated (variation #2). During that period, more than 1.8 million acres were treated requiring slightly more than 6,000 individual aircraft loads (assuming 300 acres treated per load). Calculated probability for variation #2 is therefore 3/6,000 or 1/2,000.

This empirical data was used to calculate an upper limit for the accident frequency. Let n be the total number of events that have occurred and are assumed to have a random distribution (i.e., according to a Poisson process), and assume that all the events are alike and independent. It is possible to deduce an expression for the upper confidence limit of the accident frequency λ. Such a limit is larger than or equal to λ with a high fixed probability, the "confidence limit" ($1-\alpha$). This is often chosen to be 95 percent. If N(a) is the number of accidents for up to n events, the upper confidence level is (Thedeen 1979):

$$\lambda_1 = \frac{X_{\alpha}^{2}\ (2(N[a] + 1))}{2n}$$

Where χ_{α}^2 is the standard chi square distribution found in statistical tables.

	$2\lambda_1 n$		
N(a)	α = .500	α = 0.05	α = 0.01
0	1.39	5.99	9.21
1	3.36	9.49	13.28
2	5.35	12.59	16.81
3	7.34	15.50	20.10
4	9.34	18.3	23.20

For no accidents (N(a) = 0) in 1,128 aircraft loads, the value of for the 95 confidence limit is 5.99; therefore, the accident frequency λ is 5.3 x 10^{-3}.

$$(\lambda_1 = 5.99 \times 2(0 + 1)/(2 \times 1{,}128))$$

For 3 accidents (N(a) = 3) in 6,000 aircraft loads, the value of for the 95 confidence limit is 15.50. The accident frequency is 1.0 x 10^{-2}.

$$(\lambda_1 = 15.50 \times 2(3 + 1)/(2 \times 6{,}000))$$

To find the annual probability of accidents, the probabilities above must be divided by the number of years for which the observations were made. This results in a value of 2.7 x 10^{-3} per year for variation #1 which took place over a 2-year period, and a value of 2.0 x 10^{-3} per year for variation #2 which took place over a 5-year period.

For variations #3 and #4, there were no historical data available from which to calculate probability. It is, therefore, assumed that the probability of occurrence is neither greater nor less than those projected for variations #1 and #2. For the purpose of this analysis, a worst case probability of 0.0020 is assigned.

The dose assumptions are summarized as follows:

Realistic dose (normal variations) = Base case dose x 1.1.

Worst case dose (abnormal variations) = Base case dose x 1.1 x 1.5.

Probability of occurrence (abnormal variations):

1. Nonscheduled insecticide = 0.0027 per year at 95 percent confidence.

2. Nonscheduled treatment = 0.0020 per year at 95 percent confidence.

3. More than scheduled treatment = 0.0020 per year at 95 percent confidence.

4. Major mixing errors = 0.0020 per year at 95 percent confidence.

The probability for any abnormal variation occurring is the sum of these probabilities or 0.0087 per year at the 95 percent confidence limit.

Probability Factors for the Occurrence of Major Accidents

Major accidents that result in the release of insecticide can occur on gypsy moth projects. Historical records were used to develop probabilities of occurrence. Two scenarios were identified and probabilities were generated for subsequent insecticide release (20 gallons or more) on land and in water.

Aircraft spills.--A review of spray incident reports from forest insect spraying in Maine (1979) and Oregon and Washington (1958-1983) indicated that 16 insecticide dumps of formulated material occurred on projects in those years. Total acreage treated during those years was more than 8.4 million acres.

Assuming that 300 acres can be treated with each lift off of an aircraft with a full insecticide load, a total of 28,000 individual lifts were required to treat 8.4 million acres. The probability of occurrence of an aircraft spill (per 300 acre load) is:

(300 acres/load)/8.4 million acres x 16 = 0.0005712 or 5.7×10^{-4} per flight.

It was assumed that 90 percent of the time application aircraft fly over land and only 10 percent of the time over water. The latter reflects an estimate of the percentage of small streams and ponds that a pilot cannot see from the air nor avoid. Probabilities for occurrence of aircraft insecticide spills over land and water are:

Land = $0.9 \times 5.7 \times 10^{-4} = 5.1 \times 10^{-4}$ per flight.

Water = $0.1 \times 5.7 \times 10^{-4} = 5.7 \times 10^{-5}$ per flight.

Truck spills.--Probability calculations for the occurrence of vehicular accidents in which a major spill of diluted or undiluted (concentrated) insecticide is released in water or on land were based upon accident rates for single unit trucks, the types commonly used in gypsy moth projects, as opposed to larger tractor-trailer or tandem trucks. The probability is based on a 100-mile trip while loaded with an insecticide.

Single unit trucks, the vehicles under consideration, travelled 353,978 million miles in 1981 according to DOT's Highway Statistics

Division. National Accident Sampling System (NASS) statistics estimate that single unit trucks were involved in 162,000 accidents that year, or one accident for 2,185,000 miles travelled. The mean probability of a unit truck accident for any 100 miles is:

$$P = 4.6 \times 10^{-5} \text{ per 100-mile trip.}$$

As accident by road type corrections appear significant, the estimate should be adjusted to reflect accident rates by type of road. The following tabulation gives accident frequency per mile for single unit truck accidents for road type based upon 1981 data:

Road Type	Single Unit Truck: Miles (million)	Single Unit Truck: Accidents	Probability of Accident/ Mile
Urban interstate	23,059	13,449	5.8×10^{-7}
Rural interstate	28,758	958	3.2×10^{-8}
Other urban road	146,195	92,430	6.3×10^{-7}

Mileage estimates for a hypothetical 100-mile route are:

Urban interstate - 30 percent.
Rural interstate - 50 percent.
Other urban roads - 20 percent.

Using the mileage estimates, an estimate of roadway accidents involving single unit trucks and adjusted for type of roadway for a 100-mile route is:

$$P = (.30 \times 5.8 \times 10^{-7} + .50 \times 3.2 \times 10^{-8} + .20 \times 6.3 \times 10^{-7}) \times 100 \text{ miles.}$$

$$P = 3.2 \times 10^{-5} \text{ per 100-mile trip.}$$

In estimating the potential for release of hazardous material, accident severity must be taken into account. The only data base available aggregates single and tandem trucks together although size of the load is categorized. As noted earlier, accident estimates provided thus far include all accidents reported to authorities regardless of severity. In adjusting for probability of release, the assumption is made that only those accidents severe enough to require towing of vehicles from the scene of an accident will result in the release of hazardous material.

For the vehicles of interest (single and tandem trucks), 68 percent involved in collisions with other vehicles, 21 percent with fixed objects, and 10 percent noncollision accidents. Towing was required

in 20 percent of the multi-vehicle collisions, 60 percent of the collisions with fixed objects, and 100 percent of the turnovers and ruptures.

Estimates of accidents leading to the release of hazardous material by accident type (based upon probability of accidents severe enough to require towing) is the probability that is most representative of an accident involving a release of insecticide.

Hypothetical 100-mile route:

Accident type	Probability of release
Collision with vehicle	$p = 4.3 \times 10^{-6}$
Collision with fixed object	$p = 4.0 \times 10^{-6}$
Noncollision accident	$p = 3.2 \times 10^{-6}$
Total	$p = 1.2 \times 10^{-5}$

The probability of a truck accident releasing insecticide is:

$P = 1.2 \times 10^{-5}$ per 100-mile trip.

Assuming that a vehicle carrying insecticide travels 100 miles during the course of a project, the probability that a traffic accident would occur in which insecticide is spilled would be 1.2×10^{-5}. It was assumed that the spill would occur on land 90 percent of the time, and in water 10 percent of the time. Probabilities for occurrence are:

$$P_l = 0.9 \times 1.2 \times 10^{-5} = 1.08 \times 10^{-5}$$

where P_l = probability of occurrence on land.

$$P_w = 0.1 \times 1.2 \times 10^{-5} = 1.2 \times 10^{-6}$$

where P_w = probability of occurrence on water.

The number of trips for a project for a specific insecticide depends upon the application rates of the insecticide used. The number of acres that a 2,000-gallon truck load of insecticide would provide coverage is dependent upon the particular chemical and its application rate. The following tabulation indicates the number of acres that can be treated with a 2,000-gallon truck shipment. Dividing the total project acreage by this value, provides the number of truck trips required for the project.

Chemical	lb a.i./acre	lbs/gallon shipped	acres/2,000 gallons
Acephate	0.75	1.5 (premixed) 1/	4,000
Trichlorfon	1.00	1.5	3,000
Carbaryl	1.00	4.0 (Sevin 4 Oil)	8,000
Diflubenzuron	0.06	0.06 (premixed) 1/	2,000

1/ Acephate and diflubenzuron are shipped as wettable powders and are mixed with the desired quantity of water at the loading site. For this analysis, it is assumed that these insecticides would be premixed and ready for application at the rate of 0.5 gallons/acre (acephate) and 1.0 gallon/acre (diflubenzuron).

Table 1 presents a summary of the probabilities for accidental tank truck and aircraft spills for a 100,000-acre project.

EXPOSURE SCENARIO DEVELOPMENT

General Assumptions for Base Case Exposures and Estimated Dose Levels

It is assumed that all insecticides will be used according to label directions. Variations in dosages (realistic, worst case) were discussed previously. For the base case dose, calculations are all based on a 1 lb a.i./acre application. To obtain exposures to specific insecticides, the dose rate of the selected insecticide in pounds active ingredient per acre (e.g., 0.75 lb a.i./acre for acephate) is multiplied by the base case exposure doses developed in this section.

The organisms considered for this risk analysis include humans, goats, rabbits, and fish. The latter three represent sources of human food and subsequent possible secondary insecticide exposure doses. The goat represents both game and domestic animals since it has a high surface area to body weight ratio that can be used as a worst case representation. Rabbits which also have a high surface to body weight ratio represent small animals such as dogs and cats. The surface to body weight ratio is the determinant of the level of dermal exposure, which is the major route of exposure for game or domestic animals. Fish were considered because of the potential for insecticides to be unintentionally applied to or to drift or be spilled into waters. Estimated exposure values are expressed in terms of dose (mg/kg of body weight) that enters the organism, assuming 100 percent retention of the material, a worst case assumption.

Organisms may be exposed to insecticides by means of skin contact (dermal route), breathing (inhalation), or eating and drinking (ingestion). These three routes of exposure include virtually all exposure situations, although fish may be considered to be exposed by total immersion (a combination of the dermal and ingestion routes).

Exposures to humans can be environmental or occupational. Environmental exposures refer to those incurred directly by persons residing in the area during application or walking through treatment areas after application operations have ceased, as well as those incurred indirectly by persons who consume animals and vegetation taken from a treated area. Occupational exposures refer to those incurred by three general groups of workers associated with insecticide application: pilots, mixers/loaders, and ground observers.

Environmental exposures to humans are calculated or estimated using explicitly-stated assumptions for each route of exposure. The specific assumptions are shown in each case. To calculate human oral ingestion, specific assumptions were made to convert animal and plant exposures to doses so that human dose levels could subsequently be calculated.

Human Exposures and Estimated Dose Levels

Workers.--Except for carbaryl, occupational exposures or doses incurred by workers following application of the specific insecticides being considered for use have not been experimentally measured. Studies conducted by the South Carolina Epidemiologic Studies Center (SCESC 1978 and 1979) and the New Jersey Department of Health, Epidemiology Studies Program (Schulze 1979) have determined the doses of carbaryl incurred by various occupational groups and residents following application to control either spruce budworm or gypsy moth, respectively. The dose values were based on urinary analysis and resulted from both dermal and inhalation exposure.

Schulze (1979) reported an average 312 ppb 1-naphthol (the carbaryl breakdown product) in the urines of pilots, mixer/loader groups with a high of 1,268 ppb. Data for the SCESC are summarized in Tables 3 and 4 on page 51 in the Final Environmental Impact Statement (FEIS). The 1-naphthol excreted in urine can be extrapolated to carbaryl exposure (dosage), by multiplying the 1-naphthol residue level by ratio of molecular weight (201 mol wt carbaryl/144 mol wt 1-naphthol = 1.39), by 3 because the Union Carbide Corporation found that 32.8 percent of the cumulative carbaryl dose is excreted as 1-naphthol during the first 12 hours (the sampling period in the tests) (SCESC 1978), and by the average urine excreted. Using the high range reported by Schulze, this translates to 2.940 mg (1.268 mg/l x 1.39 x 3 x 0.556 l urine) or a dose to a 70 kg worker of 0.042 mg/kg (2.940 mg/70 kg). Using this conversion, the average loader value reported by SCESC (1978) (FEIS, Table 3) translates to 0.029 mg/kg (1.144 mg/l x 1.39 x 3 x 0.422 l x 1/70 kg). Lavy and Mattice (1984), Lavy et al. (1982), and Leng et al. (1982) found exposures to mixer loaders for 2, 4, 5-T, 2, 4-D, paraquat, MSMA (monosodium methanearsonate), and EPN (o-ethyl-o-(4-nitrophenyl) phenylphosphonothioate) to range from 0.012 to 0.127 mg/kg. Based on these 6 studies for various pesticides, it was assumed that doses to mixer/loaders would not exceed 0.1 mg/kg/day for all

insecticides. Exposures to pilots were roughly one-third that received by mixer/loaders; therefore, all occupational exposure to project personnel other than observers was assumed to be equal to that received by the mixer/loader group.

Observers.--Since direct exposure of observers is possible, the low value reported by Schulze (1979) or SCESC (1979) for project observers such as scouts, rangers, and ecologists (FEIS, Tables 3 and 4) was replaced with a calculated value. It was assumed that a 70 kg observer received one direct exposure per day, that the area of exposed skin was 2 ft^2, and that the absorption rate of the insecticide was 10 percent. Thus, for every pound of active ingredient applied per acre, approximately 10 mg will be deposited on each ft^2 of surface (454 g/lb x 1,000 mg/g x lb/acre x 1 acre/43,560 ft^2).

Consequently, the observer will receive a dose of 0.029 mg/kg/day (10 mg/ft^2 x 0.1 x 2 ft^2/person x person/70 kg) for each pound of insecticide applied per acre.

General Public.--Exposure studies by Schulze (1979), SCESC (1978 and 1979), Maitlen et al. (1982) were evaluated to estimate exposure to residents who live in treatment areas. Schulze reported finding no detectable exposure to residents in the spray area. The resident exposure values found by SCESC (1978 and 1979) (FEIS, Tables 3 and 4) range from nondetectable to 2,556 ppb with only 20 percent of the residents reporting measurable amounts. The one high value of 2,556 ppb was for a resident who reported using carbaryl on his own garden and subsequently was disregarded in this analysis. The next highest exposure level reported was 247 ppb which translates to 0.0017 mg/kg (0.247 mg/l x 1.39 x 0.338 liters urine x 1/70 kg). Maitlen reported 0.3 mg/hr exposure to a bystander from applications of carbaryl to orchards. Assuming 8 hours exposure and a 10-percent absorption rate, a 70 kg person would be exposed to 0.0034 mg/kg (0.3 mg/hr x 8 hr x 0.1 x 1/70 kg). Based on this data, it was assumed that doses to residents would not exceed 0.01 mg/kg/day for each 1 lb a.i./acre applied under normal base case conditions. This includes dermal and inhalation exposure and includes secondary exposure doses from insecticide residue on grass, foliage, cars, yard items, etc. The SCESC data (FEIS, Tables 3 and 4) shows that exposure to project scouts (observers) who were not exposed to a direct application but who entered the spray areas immediately after application ranged from 0.0004 to 0.0009 mg/kg. Therefore, it is assumed that exposure to individuals who are indoors during application, but who receive indirect exposure to insecticide residues is below 0.0009 mg/kg. However, exposures could be as high as those for a project observer if a resident was outside watching the application (voluntary) and received a direct application.

Exposure to residents who live adjacent to or near treatment areas can result from drift. Witt (1984) reviewed a number of drift studies and reported drift values of 2, 0.5, and 0.15 percent of the

amount deposited on targets at distances of 1/4, 1/2, and 1 mile, respectively, for an application with a fine (75-100 um drop size) spray. This indicates that a person standing in the open, but 1/2 mile from the treatment site would receive 0.5 percent of the dose received by an observer or 0.00015 mg/kg (0.029 mg/kg x 0.0005). Extrapolating this data for near range drift, shows that doses should be 20 to 30 percent of those in the treatment area at a distance of 250 feet or about 0.002 mg/kg for a resident.

Exposure by inhalation has already been estimated in the occupational and residential exposure values because they are based on results of urine analysis which represents exposure by all routes. Air sampling data from SCESC (1978 and 1979) showed that respiratory exposure averaged 0.003 mg/m³ in the spray areas and ranged from 0.00005 to 0.00025 mg/m³ near residential areas located 0.6 miles from the spray areas.

In summary the estimated doses used in this analysis are as follows:

Mixers/loaders	-	0.1 mg/kg/day, independent of application rate
Observers	-	0.029 mg/kg/day for each pound a.i. applied/acre
Residents	-	0.01 mg/kg/day for direct exposure for each pound a.i. applied/acre
	-	0.002 mg/kg/day for near range drift
	-	0.0009 mg/kg/day for indirect exposure

Animal Exposures and Estimated Dose Levels

Dermal.--Dermal exposure to insecticides for animals (wildlife, livestock, domestic) in the treatment areas is a function of the deposition rate on the animal and of the surface area contacted by the deposited spray. Smaller animals represent a proportionately larger surface area per unit weight.

Animals can be found in either rural or suburban areas where gypsy moth suppression and eradication projects are conducted. Ground level deposition from aerial application of insecticides is partially shielded by overstory foliage and is approximately one-third of that at the overstory (Newton and Dost 1981), or 35 mg/m² for a 1 lb/acre application at the level where it would be deposited on animals. This is a conservative estimate since it is probable that wildlife, livestock, and domestic animals will be frightened by aircraft overflight and seek cover.

Goat dermal exposure and dose assume the following:

- the goat weighs 40 kg (88 lbs.) and has 2.3 m^2 surface area.
- the dorsal surface is contacted by deposited spray.
- treated foliage contact the goat's sides and stomach as the animal walks through it, at a concentration equivalent to direct deposition.
- dermal absorption rate is 10 percent.

The estimated dermal exposure to a goat is 2.02 mg/kg (35 mg/m^2 x 2.3 m^2/goat x goat/40 kg) for each pound of active ingredient applied per acre. The estimated dermal dose to the goat is 0.202 mg/kg (2.02 mg/kg x 0.1).

Rabbit dermal exposure and dose assume the following:

- the rabbit weighs 2.0 kg and has 0.23 m^2 surface area.
- the dorsal surface is contacted by deposited spray.
- the ventral surface is contacted by treated foliage as the animal walks through it, with an insecticide concentration equivalent to direct deposition.
- dermal absorption rate is 10 percent.

The estimated dermal exposure to rabbits is 4.03 mg/kg (35 mg/m^2 x 0.23 m^2/rabbit x rabbit/2 kg) for each pound of active ingredient applied per acre. The estimated dermal dose to the rabbit is 0.403 mg/kg (4.03 mg/kg x 0.1).

Inhalation.--Inhalation exposures of animals in treatment areas would occur on a one-time basis and would be limited to a short (measured in minutes at least) time. Lavy and Mattice (1984) showed that dermal exposure accounts for 99.8 percent of the exposure in humans. Exposure by inhalation is therefore 0.2 percent. Assuming that inhalation by animals is similar to humans, exposure by this route in animals would therefore be expected to be so small that it would be within the error of the dermal exposure calculations. It is subsequently excluded from analysis.

Immersion.--Exposure to fish is based on the two major assumptions that direct applications could inadvertently be made to streams or ponds during insecticide application and that the minimum average water depth would be 6 inches. An unintentional direct application to open water will result in 10 mg/ft^2 for a 1 lb/acre application (454 g/lb x 1000 mg/g x 1 lb/acre x 1 acre/43,560 ft^2). For a water body with a depth of 6 inches, the resulting concentration would be 5.0 mg/ft^3, or 177 mg/m^3, for the base case.

This is equivalent to a concentration of 177 ppb (177 mg/m^3 x m^3 water/10^9 mg) in water for every pound of active ingredient applied per acre. In comparison, as stated in the FEIS (p. 45-47) actual residue values resulting from 1 lb/acre applications of carbaryl range from 30 to 80 ppb. To be conservative, exposure and subsequent dose to fish will be assumed to be 177 ppb for every lb/acre applied.

A study of insecticide drift away from a seed orchard in the south (Barry et al. 1983) showed that residues 26 ft away from the spray site were 20 percent of those in the spray block. At 350 feet the residue was only 0.04 percent of that found in the orchard. This suggests that if the stream does not receive a direct application, the exposure level would be reduced by 80 percent (35 ppb) to over 99 percent (0.07 ppb).

Oral.--Animals may be exposed to insecticides through oral ingestion of contaminated materials. Animals may ingest plant material and water and may also be exposed because of grooming or fur licking. Since insecticides are usually rapidly degraded (see Table 2, FEIS) or, if not degraded, translocated to often inedible plant parts, exposure to animals by ingestion of plants will be only a short-lived phenomenon.

In some cases, exposures were not considered because they are insignificant. It should be noted that animals may consume some amounts of insecticide if they lick dewfall from foliage that has recently been sprayed; however, such ingestion is difficult to quantify. In addition, oral exposure due to ingestion of insecticide by licking of fur is difficult to quantify, although it is more likely to occur in small grooming mammals and preening birds than in goat, and the areas that these mammals tend to groom, such as the belly, are less likely to have high insecticide concentrations than the back.

Goat oral exposure and dose assume the following:

- post-spray concentration of insecticides in browse would be, at a maximum, 100 ppm per lb applied per acre (Back 1961).

- a typical goat weighs 88 lbs (40 kg) and eats 2.5 lb (1.15 kg) field weight foliage per day.

- oral dose equals oral exposure.

Thus, the exposure for a goat due to oral ingestion would be 2.88 mg/kg/day (100 mg/kg x 1.15 kg/goat/day x goat/40 kg) for each pound of active ingredient applied per acre. Estimated dose is the same (2.88 mg/kg/day).

Rabbit oral exposure and dose assumes the following:

- insecticide concentrations in food foliage would be 35 ppm per pound of insecticide applied per acre (Back 1961).

- a typical rabbit weighs 2.0 kg, eats 60 g of food (dry weight) daily, and receives a dose of 0.03 mg/kg/day for each ppm in food (Lehman 1959).

- oral dose equals oral exposure.

Thus, a typical rabbit would have an exposure of 1.05 mg/kg/day (35 ppm x 0.03 mg/kg/day/ppm) for each pound of active ingredient applied per acre. Estimated dose is the same (1.05 mg/kg/day).

In summary the estimated doses for animals are:

<u>Dermal</u>

Goats	-	0.202 mg/kg/day
Rabbits	-	0.403 mg/kg/day

<u>Oral</u>

Goats	-	2.88 mg/kg/day
Rabbits	-	1.05 mg/kg/day

<u>Immersion</u>

Fish	-	0.177 mg/kg/day

Environmental Exposure to Humans and Estimated Dose Levels

Environmental exposures of insecticides to humans occur through all major routes of exposure. They result from spray drift, runoff, and accumulated concentrations of insecticides in water, vegetation, and meat. Consequently, environmental exposures to insecticides are discussed in terms of the route of exposure. Calculations were made for the organisms of concern for each route of exposure, where appropriate, based on reasonable assumptions regarding application practices and organism behavior.

Individuals in treatment blocks, or persons downwind of the application site, may be exposed to insecticides by dermal contact, inhalation, or ingestion. However, as seen by the data presented previously, dermal and inhalation exposures to persons downwind are low relative to those experienced by project personnel. For example, residents or casual visitors, to spray blocks should not be expected to receive a dermal exposure higher than that of the project observer who is in the treatment area and receiving direct spray deposition. Additionally, Ghassemi et al. (1982) modeled drift resulting from aerially applied insecticides and found that worst case dermal exposure resulting from spray drift 1 km downwind was approximately 4.5 percent of the dose applied. Inhalation exposure was estimated to be 0.00099 mg/kg at the same distance. Consequently, occupational and resident exposures to the insecticides which have already been discussed (and include both dermal and inhalation exposures) were considered to be a worst case,

and environmental dose levels to humans by dermal and inhalation routes were not considered further. However, since any human may eat vegetation (fruits or vegetables) and meat (domestic or game) that may contain insecticide residues, environmental exposure levels by the oral route are considered in this analysis.

Oral exposures to humans occur through ingestion of fish, meat, vegetation, and water. The levels of exposure would be a function of insecticide concentration in the food or water as well as the quantity of material consumed.

Consumption of fish.--Oral dose estimates for human consumption of fish, which are exposed through the single route of immersion, assume the following:

- insecticide concentrations in water will not exceed 177 ppb per pound of active ingredient applied per acre under normal operating conditions.

- the low octanol/water portion coefficients, 0.04 for acephate, 3 for trichlorfon, and 240 for carbaryl, indicate that these insecticides should not be fat soluble or accumulate in fish tissue. The relatively high-value of 5,000 for diflubenzuron indicates that it could bioaccumulate; however, studies by Schooley and Quistad (1979) indicate that bioaccumulation should be minimal. This analysis assumes a bioconcentration factor of 1.0 for each insecticide (very conservative).

- insecticide residues are evenly distributed in fish tissue.

- fish with the highest tissue concentrations are most likely to be in shallow streams and ponds. A reasonable expectation for fish consumption is 0.5 kg/day.

Consequently, fish tissue concentrations are estimated to be 0.177 ppm (0.177 ppm x 1), which is equivalent to 0.177 mg/kg for each pound a.i. applied per acre. Human consumption of 0.5 kg of fish would result in a dose of 0.0013 mg/kg/day (0.177 mg/kg x 0.5 kg/day/person x person/70 kg) for a 70 kg person.

Consumption of meat.--Oral dose estimates for human consumption of game or domestic meat (represented by the goat and rabbit surrogates) assume the following:

- goat and rabbit meat (or that of their representative animal) will come from game that may have been in the target spray zone during insecticide application and that may have eaten sprayed vegetation.

- maximum residues of insecticides in the meat are the result of both oral and dermal dose to the animal (domestic or game), which in turn are a result of the level of exposures of the animal to the insecticides, assimilation of the insecticide, and duration of exposure.

- assimilation of the insecticide into animal tissue is 10 percent of the estimated doses to the animals.

- maximum insecticide residues are evenly distributed in meat tissue.

- estimated human daily consumption of meat totals 0.5 kg per day.

Insecticide residues in goat meat are estimated to be 0.308 mg/kg [(0.202 mg/kg + 2.88 mg/kg) x 0.1] for every pound a.i. applied per acre. Since it is assumed that a person would eat as much as 0.5 kg of meat per day, the human dose resulting from eating contaminated meat would be 0.0022 mg/kg/day (0.308 mg/kg/day x 0.5 kg/day/person x person/70 kg).

Insecticide residues in rabbit meat are estimated to be 0.145 mg/kg [(0.403 mg/kg + 1.05 mg/kg) x 0.1] for every pound a.i. applied per acre. Since it is assumed that a person would eat as much as 0.5 kg of rabbit meat per day, the human dose resulting from eating rabbit meat containing insecticide residues would be 0.0010 mg/kg/day (0.145 mg/kg/day x 0.5 kg/person x person/70 kg).

<u>Consumption of water</u>.--Oral exposure estimates for human consumption of water containing residues assume the following:

- water sources will have a minimum average depth of 6 inches, resulting in maximum insecticide concentrations of 0.117 ppm (.117 mg/liter) at 1 lb/acre application.

- daily consumption of water is 2 liters.

- water will be consumed for 1 day.

- runoff into such water bodies from rain within 10 days (based on half-life data) (Table 2 FEIS) after spray application may result in brief increases in the concentration of insecticide. But due to their transitory nature and the relatively small contribution of drinking water to human exposure compared to the dermal exposure values already estimated, runoff is unlikely to be a significant contributing factor for exposure and is thus not considered in this analysis.

Thus, the human exposure of insecticides contributed by drinking water would be 0.0033 mg/kg/day (0.117 mg/liter x 2 liter/person/day x 1 day x person/70 kg).

Consumption of fruit and vegetables.--Oral ingestion of contaminated vegetation was considered, but no data is available. However, the U.S. Food and Drug Administration has set food tolerances for these insecticides that result from direct application. Residues range from 0.1 to 10 ppm for the type of vegetables or fruits that could be exposed during the application period. Vegetables or fruits are assumed with concentrations in the 0.1 to 10 ppm range (0.1 mg/kg to 10 mg/kg) for a direct application. Using the highest concentration estimated, the human exposure to insecticides contributed by contaminated vegetation could be as high as 0.07 mg/kg/day (10 mg/kg x 0.5 kg/person x person/70 kg) for each pound of a.i. applied per acre.

Summary of Exposures for the Base Case

The base case dose levels estimated for humans are summarized below, and result from an application rate of 1 pound a.i. applied per acre. An increase or decrease in the application rate is assumed to produce a proportionate number.

Dermal and Inhalation Doses for Humans

Mixers/loaders	- 0.1 mg/kg
Observers	- 0.029 mg/kg
Residents	- 0.01 mg/kg for residents in the spray area
	- 0.002 mg/kg for residents downwind
	- 0.0009 mg/kg for residents indirectly exposed

Oral Doses for Humans

Eating fish	- 0.0013 mg/kg
Eating rabbit	- 0.0010 mg/kg
Eating goat	- 0.0022 mg/kg
Drinking water	- 0.0033 mg/kg
Eating vegetables and fruits	- 0.0007 to 0.0700 mg/kg
Total	0.0085 to 0.0778 mg/kg

Estimated worst case exposure from a daily diet consisting of 0.5 kg of meat, 0.5 kg of vegetables and fruits, and 2 liters of water = 0.0022 + 0.0033 + 0.07 = 0.0755 mg/kg/day.

Accidental Exposures

Worst possible exposures to humans, animals, or fish can result from accidental events such as large spills at the mixing/loading site or dumps on land or into potable water sources. Dumps can occur from the emergency jettison of loads by aircraft or from trucking accidents.

The size of the spill or dump and the resulting impact depends on many variables such as spill source (truck or aircraft), size of load, distance to water, stream size, and density of human or animal population. Application incidents are assumed not to be greater than 300 gallons because that is the average load carried by the type of aircraft commonly used. Dumps resulting from transportation of the insecticides to the site have the potential of being much larger. A 2,000-gallon maximum was assumed because of limitations in truck capacity for the types of tank trucks used in gypsy moth suppression and eradication projects.

Aircraft-originated spills.--Other assumptions made to evaluate exposure from a jettison are:

- the entire load was dumped in 15 seconds.

- the aircraft speed was 100 mph.

- the jettison was over a residential area in one case and over 2 streams (a 25-foot wide stream with a discharge rate of 250 cubic feet per second (CFS) and a 15-foot wide stream with discharge of 70 cfs).

- the tank mix contains 1 lb a.i./gal.

- the width of the spill is equivalent to the wing span of the aircraft (50 feet).

Based on the above assumptions, the spill size will cover 11,000 ft^2 (100 mi/hr x 1/3,600 sec/hr x 5,280 ft/mi x 15 sec x 50 feet wide). The deposit on each ft^2 of surface resulting from the 300-gallon dump of 1 lb a.i./gal insecticide is 12,382 mg/ft^2 (300 lb x 454 g/lb x 1,000 mg/g x 1/11,000 ft^2). If a 70 kg person was in the dump area, some physical injury could be possible. The dermal dose to exposed skin, again assuming 2 ft^2 exposed skin and 10 percent absorption rate, is 35.38 mg/kg (12,383 mg/ft^2 x 0.1 x 2 ft^2/person x person/70 kg). Exposure could conceivably be greater than this because of the volume of liquid (0.03 gal/ft^2 that would also come in contact with clothing. Assuming clothing allows 25 percent of the liquid to come in contact with skin and the liquid is

concentrated on one side of the person, the wet clothing adds 17.69 mg/kg to the dose (12,382 mg/ft^2 x 0.1 x 0.25 x 8 ft^2 clothing/person x ½ clothing x person/70 kg). Total maximum exposure is therefore estimated to be 53 mg/kg (35.38 mg/kg + 17.69 mg/kg).

If the spill is directly over a steam, the mean 24-hour concentration (MC 24) level in ppb can be calculated by the following equation (USDA Forest Service 1984):

$$MC\ (24) = \frac{185 \times \text{lbs of insecticide}}{\text{cfs}}$$

To simplify calculations, it is assumed that all of the insecticide would land in the stream. Actually, only half would land in a 25-foot wide stream.

For the two streams considered, MC(24) values are 222 and 793 ppb for the 25- and 15-foot streams, respectively. If a 70 kg human drank this water, the dose would be 0.006 mg/kg (0.222 mg/liter x 2 liters/person/day x 1 day x person/70 kg) and 0.023 mg/kg (0.793 mg/liter x 2 liters/person/day x 1 day x person/70 kg), respectively.

For aircraft spills, exposure summaries (based on 1 lb a.i./acre are:

Dermal (partial)	-	35.4 mg/kg.
Dermal (full)	-	53 mg/kg.
Drinking water	-	0.023 mg/kg.

Vehicle-originated spills.--Direct exposure to bystanders from a spill involving transportation is so unlikely it was not evaluated. Only rapid spills and exposure to mixer/loaders/truck drivers and water was considered. Slow, hose type, leaks are controlled quickly so the impact would not be as great as the large spill. However, it is assumed that occupational exposure is the same for large or small spills because mixer/loader/drivers are involved with the initial containment and clean-up.

Since no data is available on occupational exposure resulting from a transportation spill, it is assumed that the mixer/loaders were exposed to the equivalent of 1 gallon of either the concentrated (carbaryl, trichlorfon) or diluted insecticide in a day. Absorption rate of the insecticide into the body is assumed to be 10 percent. Consequently, a 70 kg worker will receive a dose of 649 mg/kg (454 g/lb x 0.1 x 1,000 mg/g x 1/70 kg) for each pound a.i./gallon.

If the spill goes into either of the streams, the MC(24) would be 1,480 and 5,286 ppb for the 25- and 15-foot streams, respectively. Human exposure from drinking this water is 0.042 and 0.151 mg/kg, respectively (1.480 or 5.286 mg/liter x 2 liter/person/day x 1 day x person/70 kg) for 1.0 lb a.i./gal mixtures. An actual spill of 1,890 gallons into a stream in eastern Oregon of carbaryl mixed 1 to 1 with fuel oil resulted in carbaryl concentrations that ranged from 4.4 to 39.9 ppm the day of the spill (USDA Forest Service 1983).

For truck spills, the multiplier to the base case exposure doses for each insecticide is:

Acephate	- 1.5 (based upon 0.75 lb a.i./acre in 0.5 gal. mix)
Carbaryl	- 4.0 (Sevin 4 Oil = 4 lb a.i./gallon)
Diflubenzuron	- 0.06 (based upon 0.06 lb a.i./acre in 1.0 gal. mix)
Trichlorfon	- 1.5 (Dylox 1.5 Oil = 1.5 lb a.i.,/gallon)

A summary of the generated base case doses by exposure scenario and insecticide are presented in Table 2. The calculated doses in Tables 2 are for those exposure scenarios developed in the previous section, but modified for the specific insecticide application rate (a.i./acre) and mixing rate (a.i./gal). The scenarios also include doses that could be encountered by the general public that would result from the actual application plus secondary or environmental exposures resulting from eating or drinking contaminated food and water (e.g., the observer and environmental or direct and environmental scenarios).

REVIEW OF TOXICOLOGICAL STUDIES

In reviewing the available information on the toxicological tests conducted to evaluate the potential risks to human health from acephate, carbaryl, diflubenzuron, and trichlorfon, the analysis concentrated on the results of the studies and not on the scientific protocol. An attempt was made to determine the dose or doses at which no effects were observed (NOEL) by the investigators. Since these studies are reported in scientific journals and receive peer review before publication, it was assumed that the study protocols were adequate. More emphasis was placed on studies that involved oral, dermal or inhalation exposure routes to live animals than those involving injected doses because the former exposure routes are more applicable to this analysis.

Based on concerns raised during scoping, the literature review was concentrated on studies dealing with birth defects (teratogenicity, embryotoxicity, and fetotoxicity), mutagenicity, and carcinogenicity for the four chemical insecticides. The data requirements for

pesticide registration proposed by the U.S. Environmental Protection Agency (US EPA 1982) were used as a guide to identify appropriate studies for evaluating possible human health impacts.

The National Institute for Occupational Safety and Health (NIOSH), World Health Organization (WHO), and Environmental Protection Agency (EPA) independently review the same types of information in respectively setting permissible exposure limits for workers and acceptable daily intakes (ADI). Threshold level values (TLV's) are determined for short-term exposure from no observable effect levels (NOEL) in animals which are scaled-up to humans using conservative assumptions and margins of safety at 10,000, or 1,000 depending upon the degree of evidence. Larger margins of safety are used for cases with low degrees of evidence. An ADI is the maximum long-term dose of a substance that is anticipated to be without lifetime risk to humans when taken daily over a 70-year lifetime. Further margins of safety are used to correct the short-term TLV into a long-term ADI. The short- and long-term values were compared to probable short- and long-term exposures, respectively, to the general public that could result from using these insecticides in gypsy moth projects.

No observable effect levels (NOEL) identified for the four insecticides are summarized in Tables 3-6. Since no effect was observed at all tested doses in these cases, the true NOEL would therefore be some value above the tested dose. The information summarized in the Tables indicates that the insecticides pose some possible risk of causing acute toxic effects, chronic cholinesterase depressions, birth defects, or mutations when specific dosage levels are exceeded. It was concluded from reviewing the data available that acephate (Seiler 1977), carbaryl (US EPA 1980), and diflubenzuron (Quarles 1980, Patel and Santolucito 1980) cannot be considered carcinogens and therefore do not pose a cancer risk. As noted in the FEIS (p. 63), there is, however, uncertainty about trichlorfon as a potential carcinogen because of its mutagenic potential. Preussman (1968) indicated that trichlorfon may also be a weak carcinogen because it had alkylating activity. There is also uncertainty about the ability of carbaryl to form N-nitrosocarbaryl which has been demonstrated to have carcinogenic potential. Since no carcinogenic potency factors were available for either trichlorfon or N-nitrosocarbaryl, the following approaches were available: 1) calculating the potency factor using the method described by Mantel and Schneiderman (1975), 2) assuming the cancer potency to be no less than that of a similar chemical (surrogate) which has a known carcinogenic potency. Cancer risk of trichlorfon and N-nitrosocarbaryl could be estimated using the carcinogen potency value for surrogates such as 1, 1, 2-trichloroethane (potency of 0.0573 $mg/kg/day^{-1}$) and N-nitrosodiphenglamine (potency of 0.00492 $mg/kg/day^{-1}$), respectively.

For this analysis, cancer potency factors (q_1^* H) were calculated as follows (Mantel and Schneiderman 1975):

N-nitrosocarbaryl

Carbaryl can be nitrosated to N-nitrosocarbaryl under conditions simulating those of the human stomach (e.g., mild acid, 37°C, in the presence of nitrite). The reaction product, a low concentration N-nitrosocarbaryl, has been shown to be a directly acting carcinogen. Eisenbrand G. et al. (1975) reported the carcinogenic effect of this compound, which induces local sarcomas in rats after subcutaneous injection of a single dose. His group also reported (in Fishbein 1978) the squamous cell carcinoma of the forestomach on male Sprague-Dawley rats at doses of 130 mg/kg twice a week. Since other reports only provide the mutagen evidence of this compound, in addition to the nonthreshold limit for carcinogen compound, this data point is used to do the potency slope (q_1^* (H) calculation.

$$\text{lifetime average exposure} = d\ \underline{1}/ = \frac{le \times m}{Le \times w^{2/3}}$$

Le = duration of experiment
le = duration of exposure
m = average dose (mg/day during le)
w = average wt of experiment animal

$m = ppm \times F \times \underline{r}$
$= mg/kg \times F \times \underline{r}$

where F is the weight of the food consumed per day in kg.

r is the absorption fraction assumed to be "one".

1/ mg/surface area-day is equivalent between species.

A empirically derived food factor, f = F/W which is the fraction of species body weight that is consumed per day as food, reported by EPA's Environmental Criteria Assessment Office, Cincinnati, Ohio, 1980 as followed:

Species	W	f
Human	70	0.028
Rat	0.35	0.05
Mice	0.03	0.13

For rats: $F = fw = 0.35 \times 0.05 = 0.0175$ (kg/day)

$$\begin{aligned} m &= \text{ppm} * F \times \underline{r} \\ &= 130 \text{ mg/kg} \ \underline{x}\ 0.0175 \text{ dk/day} \times 1 \\ &= 2.275 \text{ mg/day} \end{aligned}$$

$$d = \frac{le}{Le} \times \frac{m}{w^{2/3}}$$

$$= \frac{2}{7} \times \frac{2.275 \text{ mg/day}}{(0.35^{2/3}} = 1.309 \text{ mg/day/surface area}$$

For humans:

$$w^{2/3} = (70)^{2/3} = 16.98$$

d(Lifetime average exposure):

$$= 1.309 \times 16.98 = 22.23 \text{ mg/kg/day}$$

Estimated $q_1^*(H)$ for N-nitrosocarbaryl is 1/22.23 =

$0.045 \ (\text{mg/kg/day})^{-1}$.

Trichlorfon

The same type of calculation can be made for trichlorfon using the data reported by Dedek et al. (1975). Mice were dosed interperitoneal (i.p.) with 405 mg/kg in a single dose and 54 mg/kg daily for 3 weeks. The duration of the experiment was 8 weeks.

Average daily dose = 405 i.p. single + 54 i.p. mg/kg daily for 3 weeks

= 405 + 1,134 = 1,539/21-day = 73.3 mg/day average

$F = fw = 0.13 \times 0.03 = 0.0039$

$m = \text{ppm} \times F \times \underline{r} = 73.3 \text{ mg/kg} \times 0.0039 \text{ kg/day} \times 1 = 0.286$ mg/day

d(lifetime average exposure) = $le \times m/Le \times W^{2/3} = 3/8 \times$

$0.286/(0.03)^{2/3} =$

1.153 mg/day/surface area

For humans $d = 1.153 \times 16.98 = 19.58$

Estimated q_1^* (H) for trichlorfon = 1/19.58 = 0.0511

For the purpose of this analysis, these estimated carcinogenic factors were used in the analysis of cancer risk discussed in the analysis of potential human health or environmental impact section.

POPULATIONS AT RISK

Public at Large

Two separate populations can be exposed to the chemical insecticides, for the general public and workers. The general public are considered to live in the same area for a 70-year lifetime (or if moving to another area, receive a similar worst case exposure over a lifetime), and is exposed to the maximum calculated dose. The hypothetical maximum exposed individual (MEI) weighs 70 kg, retains 100 percent of intake (worst case assumption), breaths 20 m^3/day air, and ingests 2 liters of water per day and 0.5 kg/ day of each item of food.

For urban/suburban areas, a density of four houses per acre with four members of a family per household results in 16 people/acre. This may be compared with an average density for metropolitan area from 1980 census data:

Total metropolitan population	= 167 million
Total metropolitan acres	= 47.4 million
Average metropolitan and population density	= 3 people/acre

Total rural population	= 59.5 million
Total rural acres	= 2.21 billion acres
Average rural population density	= 0.03 people/acre

This number can be scaled-up to a density of 0.16 people/acre, rounded to 0.2 people/acre.

For gypsy moth eradication projects, the approximate historic breakdown of target areas, based upon location of treatments from 1967-1983 is:

Area	Percent of Program	Population Density per Acre
Urban/suburban	59	16
Rural	41	0.2

A composite population density is: (0.59 x 16) + (0.41 x 0.2) = 9.5 people/acre.

For gypsy suppression projects, the general historic breakdown of target areas is:

Area	Percent of Program	Population Density per Acre
Urban/suburban	85	16
Rural	15	0.2

A composite population density for gypsy moth suppression projects is:

$$(0.85 \times 16) + (0.15 \times 0.2) = 13.6.$$

For this analysis, a conservative estimate of 14 people/acre will be used for both eradication and suppression projects.

As indicated by the exposure data generated earlier in this analysis, the dose potential is greatest for the occupationally exposed group. One can assume that those residents who remain indoors during spraying do not receive any direct doses, but may pick up some contamination afterwards when walking outside. If one assumes that half the population remains indoors (most spraying occurs in early morning, although in some cases, spraying conditions could last through early afternoon), then only one-half of the population would receive a full, direct maximum dose. All of those outdoors in the spray area and observing the treatment, receive the maximum dose and are therefore considered as maximum exposed individuals (MEI). Those downwind receive proportionally less as described earlier.

Sensitive Populations

Sensitive members of the general public include the following cohorts: infants, young children, people allergic or sensitive to chemical insecticides, pregnant women, and the elderly. As a result these groups require special consideration in the analysis.

The values for NOEL's TLV's, and ADI's identified and used in this analysis have considerable conservatism in the use of margins of safety. These are compared to the exposure doses generated as based upon a 70 kg (154 lb) individual, a generally accepted figure for an adult male. The weight of recipients is especially important when considering exposure to sensitive populations such as children and infants.

In order to account for the weight differences between children and adults, and also to address the other sensitive members of the population, a safety factor of 10x is applied to the realistic and worst case doses generated for the general public scenarios. The resulting dose estimates are then compared to the identified NOEL's, TLV's, and ADI's.

EXPOSURE SUMMARIES AND DETERMINATION OF HUMAN HEALTH IMPACT

General Populations and Workers

A summary of established exposure thresholds and carcinogenic potency slopes used in the analysis is presented in Table 7. A comparison of the calculated doses (realistic and worst case) by scenario to established exposure thresholds for the insecticides is presented in Tables 8-11. A summary of those exposure scenarios

where effects are possible, including a probability of occurrence and potential number of people exposed, is presented in Table 12.

Acephate.--In each of the General Public and Occupational Exposure scenarios, both the realistic and worst case doses are below the NOEL and TLV. Doses are above the ADI in both occupational scenarios and in the three general public scenarios in which environmental exposures are taken into account. Since all of those exposures are below the NOEL, no effects are expected.

Dermal exposure levels resulting from aircraft spills are well below the LD_{50} for acephate, but could conceivable cause a decrease in cholinesterase activity depending upon how quickly exposed persons bathe and change clothing. Any decrease in cholinesterase activity at these dose levels is temporary. The probability of aircraft spills occurring (Table 12) is 4.5×10^{-4} or 0.00045 per flight. The potential number of people (general public) that could be exposed to the incident is 3.5.

Dermal exposures resulting from contact with insecticide as a result of a truck accident are estimated to be above the LD_{50}. Acute effects are expected with possible fatalities if protective clothing is not used. It is assumed that only 2 workers will be exposed to the incident. The probability of a truck spill occurring is estimated to be 1.08×10^{-5} or 0.0000108 per 100 miles travelled.

Drinking water that contains acephate resulting from the accidents is less hazardous due to the diluting effect of water. Dose levels in water resulting from aircraft spills are below the NOEL for both the realistic and worst case doses and below the established ADI for the realistic dose. No effects are expected as a result of drinking 2 liters of this water per day. Realistic dose levels in water resulting from truck spills are below the NOEL, but the worst case dose is slightly above the NOEL. In this latter case, a decrease in cholinesterase activity could occur from drinking 2 liters/day of this water; however, the effect is temporary. The probability of a truck spill releasing insecticide in water is estimated to be 1.2×10^{-6} (Table 12). It is assumed that the number of people that could be exposed to this incident would be all of those who may drink the water. The probability that a tank truck spill in water contains a worst case dose is 0.0087 per project.

Carbaryl.--Similar to the calculated exposure levels for acephate, all of the general public and occupational scenarios are below the lowest NOEL and the TLV; therefore, no effects to the general public will occur.

Potential doses in water resulting from aircraft spill or vehicle accidents are all below the NOEL and no effects are expected from drinking 2 liters of water/day.

Dermal exposures resulting from aircraft spills are well below the established LD_{50}. It is possible that those potentially exposed (estimated 3.5 people) might exhibit symptoms of decreased

cholinesterase activity depending upon how soon they bathe and change clothing following exposure. The probability that an aircraft spill would occur is estimated to be 5.1×10^{-4} or 0.00051 per flight.

Dermal exposures resulting from contact with concentrated carbaryl spills (vehicular accidents) are above the established LD_{50}. Acute effects are expected with possible fatalities if protective clothing is not used. It is assumed that only 2 project workers associated with spill containment would be exposed to the incident. The probability of a vehicle accident occurring and insecticide being released is estimated to be 1.08×10^{-5} or 0.0000108 per 100-mile trip.

<u>Diflubenzuron</u>.--General public and occupational exposure scenarios for all dose levels (realistic and worst case) are below the lowest established NOEL, the estimated ADI and the TLV. The highest exposure scenario for the general public (observer and environmental - worst case dose) is 40 times less than the lowest NOEL. No potential adverse effects are indicated.

Dermal exposures resulting from accidents (aircraft spill and truck spill) are well below the LD_{50}. No acute effects or symptoms are expected. Consumption of water contaminated with diflubenzuron as a result of the accident scenarios will not cause any effects since exposure levels are below the lowest NOEL and the TLV.

<u>Trichlorfon</u>.--General public and occupational exposure scenarios for all dose levels (realistic and worst case) are below the lowest established NOEL and the TLV. No effects to the general public or the occupational group will occur. Consumption of water contaminated with trichlorfon as a result of accidents (aircraft spill and truck spills) will not cause any effects since all exposure levels are below the lowest NOEL and the TLV.

Dermal exposures resulting from aircraft spills are below LD_{50}; however, they are high enough that some effects are possible depending upon how soon after exposure individuals bathe and change clothing. For the realistic dose dermal (partial) decreased cholinesterase activity is possible. For the worst case (full) fatalities are possible. The probability, to the potentially exposed population (3.5 people) of an aircraft spill occurring is 5.1×10^{-4} or 0.00051 per flight. If an aircraft spill occurs, the probability of the spill containing the worst case dose is 0.0087 per project.

Dermal exposures for the realistic and worst case dose resulting from spills of concentrated trichlorfon (vehicle accident) are both the established LD_{50}. Fatalities are probable if protective clothing is not used. It is assumed that only project personnel (2) and not the general public would be dermally exposed to the spill. The probability of such an incident occurring is 1.08×10^{-5} or 0.0000108 per 100-mile trip.

Sensitive Populations

A comparison of calculated doses for sensitive populations to established exposure thresholds for the insecticides is presented in Tables 13-16. A summary of general public scenarios for sensitive populations where effects are possible is presented in Table 17.

Acephate.--Realistic and worst case doses for dermal only exposure scenarios for sensitive populations are below the lowest NOEL. No potential adverse effects are indicated. Highest potential exposures are estimated for those individuals who receive involuntary direct exposure, voluntary direct exposure, and indirect exposure, in addition to exposure from consuming food and water containing acephate residues. All of these exposures are above the established ADI, TLV, and lowest NOEL except the indirect and environmental realistic dose which is below the established TLV. All of these exposure scenarios are below the second lowest NOEL. Temporary decrease in cholinesterase activity is possible depending upon the quantity of food and water containing acephate residues consumed. No effects are expected if contaminated foods are not consumed.

Carbaryl.--Realistic and worst case doses for dermal only exposure scenarios for sensitive populations are below the TLV and the lowest NOEL. The highest potential exposures occur for individuals directly or indirectly exposed during carbaryl application and who consume food and water containing carbaryl residues. In these exposure scenarios, the doses received (realistic and worst case) are below the lowest NOEL. No effects will occur to sensitive populations are indicated in this analysis.

Diflubenzuron.--Realistic and worst case doses for dermal only exposure scenarios for sensitive populations are below the ADI, TLV, and lowest NOEL. Realistic and worst case doses for all individuals dermally exposed and who consume food and water containing diflubenzuron residues are above the estimated ADI, but below the TLV and the lowest NOEL. No effects will occur to sensitive populations are indicated in this analysis.

Trichlorfon.--Realistic and worst case doses for dermal only exposure scenarios for sensitive populations are above the ADI, but below the TLV and the lowest NOEL. No potential adverse effects are indicated as a result of these exposure scenarios. Realistic exposure levels for the direct and environmental and the indirect and environmental scenarios are above the ADI and TLV, but below the lowest NOEL. No effects are expected to these groups. Worst case doses to the same groups are above the ADI, TLV, and the lowest and next lowest NOEL's. Some effects are possible. The realistic dose estimated for the observer and environmental group is above the ADI, TLV, and lowest NOEL, but below the second lowest NOEL. Some effects are possible. The probability of a worst case dose occurring is 0.0087 per project. The worst case dose estimated for the observer and environmental group is above the ADI, TLV, and second lowest NOEL. Some effects are possible. The probability of a worst case dose occurring is 0.0087 per project.

Assessment of Cancer Risk

The plausibility of the occurrence of cancer over a lifetime as a result of using carbaryl or trichlorfon (realistic or worst case dose) in gypsy moth eradication or suppression projects is determined using the following equation:

$$P_c = \text{Dose} \times c \times PS \times E_1 \times D_e / 25{,}550 \text{ days}$$

where P_c = plausible estimate of lifetime cancer risk

Dose = dose of the maximum exposed individual (MEI)

PS = cancer potency slope developed earlier

c = conversion factor representing the amount of the suspected carcinogen actually available

E_1 = number of exposures per lifetime (10 for suppression projects; 6 for eradication projects)

D_e = days of maximum exposure during each exposure period (1)

25,550 = number of days in a 70-year lifetime.

The "c" constraint was employed because the risk of cancer associated with using carbaryl comes from N-nitrosocarbaryl. Therefore, the exposure to carbaryl must be multiplied by some factor representing the production of N-nitrosocarbaryl from the nitrite ion and carbaryl. The data presented in the FEIS (page 56) indicates that *in vivo* production of N-nitrosocarbaryl was only 0.2 percent of the production when the reaction takes place outside the organism. Assuming that the ideal production outside the organism is 100 percent, the conversion factor is the 0.002. We use a conversion factor of 1.0 for trichlorfon even though Fishbein (1978) reported that the genetic effects of trichlorfon were probably due to the action of its degradation products. Since we could find no information on the relative production of these metabolites *in vivo*, a conversion factor of 1.0 is a worst case assumption.

The probability of cancer to the maximum exposed individual (MEI) over a 70-year lifetime for realistic and worst case doses of carbaryl and trichlorfon is presented in Table 18. The weighted cancer risk is calculated as follows:

0.0087 x (worst case risk estimate) + 0.9913 x (realistic risk estimate)

where 0.0087 = probability of worst case dose being applied

0.9913 = probability of realistic dose being applied.

This method is used to determine the worst case impact of the cancer risk. To get the number of possible incidences of cancer per acre over a lifetime series of applications, the cancer risk is multiplied by the population at risk (14 individuals/acre based on assumptions previously stated). This translates to the lifetime incidences of cancer per acre for the lifetime number of applications.

Insecticide/ Exposure Scenario	Incidences of cancer/acre/lifetime number of applications	
	Suppression (for 10 applications)	Eradication (for 6 applications)
Carbaryl		
Observer and Environmental	5.7×10^{-8}	3.4×10^{-8}
Direct and Environmental	4.6×10^{-8}	2.8×10^{-8}
Trichlorfon		
Observer and Environmental	3.2×10^{-5}	1.9×10^{-5}
Direct and Environmental	2.6×10^{-5}	1.6×10^{-5}

Since neither carbaryl nor trichlorfon are used for a total project, nor would they be used for successive sprayings over the next 70 years, it is not possible to scale these figures upward by the number of acres treated without reference to a specific gypsy moth project. In a site-specific environmental assessment, these impacts can be calculated for a single treatment as follows:

Carbaryl

Observer and environmental No. of acres x 5.7×10^{-9}
Direct and environmental No. of acres x 4.6×10^{-9}

Trichlorfon

Observer and environmental No. of acres x 3.2×10^{-6}
Direct and environmental No. of acres x 2.6×10^{-6}

For sensitive populations, where a safety factor of 10x was built into the exposure scenarios, the risks of cancer increase ten-fold. The lifetime incidences of cancer per acre for the lifetime number of applications is estimated to be:

Insecticide/ Exposure Scenario	Incidences of cancer/acre/lifetime number of applications	
	Suppression (for 10 applications)	Eradication (for 6 applications)
Carbaryl		
Observer and Environmental	5.7×10^{-7}	3.4×10^{-7}
Direct and Environmental	4.6×10^{-7}	2.8×10^{-7}
Trichlorfon		
Observer and Environmental	3.2×10^{-4}	1.9×10^{-4}
Direct and Environmental	2.6×10^{-4}	1.6×10^{-4}

The actual probabilities are lower than those above since the analysis assumes that the population density (14/people/acre) are all members of the sensitive group. In a site-specific environmental assessment, these impacts can be calculated for a single treatment as follows:

Carbaryl

Observer and environmental   No. of acres x 5.7×10^{-9}
Direct and environmental   No. of acres x 4.6×10^{-9}

Trichlorfon

Observer and environmental   No. of acres x 3.2×10^{-6}
Direct and environmental   No. of acres x 2.6×10^{-6}

SUMMARY AND CONCLUSIONS

The realistic dose levels generated in this analysis for the general public (direct, drift, indirect) and the occupational (mixer/loaders, observers) exposure scenarios are based upon actual exposure data collected in pesticide studies and rounded upwards to represent a conservative estimate. The worst case dose level is based upon worst case assumptions. The environmental exposure scenarios, representing secondary exposure to the insecticides via consumption of food and water that might receive insecticide deposit and indirect exposure via contact with cars, toys, lawn furniture, vegetation, etc., that may have insecticide residues present, are based upon worst case assumptions.

The dose levels for the general public and occupational exposure scenarios were evaluated against established long-term and short-term exposure thresholds gathered from available scientific literature. The ADI's and NOEL's are measurements of chronic exposure that represent safe daily exposure levels over the lifetime

of an individual. The TLV's represent safe occupational exposure levels for an 8-hour day and 5-day working week over the working lifetime of individuals, and are subsequently more applicable to the scenarios developed in this analysis for the occupational group. It is important to emphasize that the insecticide exposure levels resulting from gypsy moth suppression and eradication projects are not daily exposures over a 70-year lifetime. The analysis assumes 6 and 10 exposures/lifetime depending upon the type of project (eradication or suppression). Comparison of estimated exposure levels to the NOEL's, TLV's, and ADI's suggests extreme conservatism at the least, and worst case at the most, in subsequent evaluation of potential effects.

Accidents such as aircraft spills and truck spills on land and in water result in one time release of large amounts of insecticide. The potential exposure levels are therefore evaluated in terms of acute effects. The probability of any of these accidents occurring is based upon available historical records and worst case assumptions.

General Population

As demonstrated in this analysis, there are no adverse human health effects identified for either the general public or occupational exposure scenarios as a result of realistic or worst case doses applied in gypsy moth suppression and eradication projects. The only major acute effects identified in this analysis were associated with accidents such as aircraft spills and tanker truck spills. This is expected. In all cases except the worst case dose for trichlorfon, exposure to aircraft spills could result at the most, in a temporary decrease in cholinesterase activity. The worst case dose could result in a greater level of cholinesterase inhibition. The level and duration of these effects is dependent upon how soon after exposure individuals bathe and change clothing. The number of people that could be exposed to an aircraft spill is estimated to be 3.5. The probability of occurrence of these incidents is very low (10^{-4}). The probability of an aircraft spill containing a worst case dose level is 0.0087 per project. Effects ranging from inhibition of cholinesterase activity to possible fatalities are possible for tanker truck spills especially where insecticide concentrate (carbaryl, trichlorfon) is released. The probability of these accidents occurring is very low (10^{-5}). The probability of a truck spill containing a worst case dose level is 0.0087 per project.

Sensitive Populations

A ten-fold increase (worst case assumption) was applied to the general public realistic and worst case dose estimates in order to estimate exposure levels for sensitive populations, including infants, children, pregnant women, the elderly, and individuals sensitive to chemical insecticides. The subsequent evaluation only

analyzed effects to the general public scenarios as it was assumed that exposure to sensitive populations under the occupational scenario is voluntary. Acute effects resulting from exposures to accident scenarios would be similar to those described in the previous section.

For the general public scenarios, there were no effects to sensitive populations identified for exposure to realistic and worst case doses of carbaryl and diflubenzuron. A temporary decrease in cholinesterase activity is possible for sensitive individuals who consume food and water containing residues of acephate; however, there were no effects to the same individuals who only received dermal exposure. As discussed earlier, environmental exposure levels (food, secondary contact, etc.) were based upon worst case assumptions.

For trichlorfon, there were no effects identified for sensitive populations dermally exposed during suppression and eradication projects. Persons directly and indirectly exposed and who also consume contaminated foods might experience a reduction in cholinesterase activity under the worst case dose (probability of occurrence is 0.0087 per project). The sensitive individual who voluntarily receives dermal exposures comparable to project observers and subsequently consumes contaminated food and water might experience a decrease in cholinesterase activity for both the realistic and worst case.

<u>Risk of Cancer</u>

The probability of the occurrence of cancer from the use of carbaryl (N-nitrosocarbaryl) and trichlorfon is based upon 6 lifetime exposures for eradication projects and 10 lifetime exposures for suppression projects. For carbaryl, the estimated incidence of cancer per acre per lifetime number of applications for the MEI (observer and environmental) is 5.7×10^{-8} for suppression projects and 3.4×10^{-8} for eradication projects. The similar estimate for trichlorfon is 3.2×10^{-5} for suppression projects and 1.9×10^{-5} for eradication projects. These estimated incidents are based upon a population density of 14 people/acre. Population density for sensitive individuals is less than 14 people/acre; however, data on this population group is unknown. For carbaryl, the estimated incidence of cancer per acre per lifetime number of applications for the sensitive population (MEI) is less than 5.7 and 3.4×10^{-7} for suppression and eradication projects. For trichlorfon, the estimated cancer incidence is 3.2 and 1.9×10^{-4} for suppression and eradication projects.

The estimated cancer incidence for carbaryl is extremely small. Realistically, it is even less than that calculated in this analysis due to the worst case assumptions made for environmental exposure. The estimated cancer incidence for trichlorfon is higher than that for carbaryl, due to the need to use worst case data assumptions,

and use of estimated cancer potency slope factors, rather than established potency factors during calculation of the cancer probabilities. The worst case data assumption used in the trichlorfon cancer risk analysis was that it was trichlorfon itself that caused mutagencic effects in laboratory studies. Existing literature (Fishbein 1978) suggests that it is breakdown products that cause the effects and not the parent compound. Therefore, cancer incidence is actually much lower than that calculated in this analysis.

Perspectives on Risks

The values for probabilities of accidents and their impact are extremely low so that multiplying probabilities and consequences together to get a very, very low "expected value" has little meaning. To put these values in perspective, one must realize that if the accident and resultant level exposures occur, there is a small probability that either an individual or an exposed population will have an acute or chronic effect or an excess cancer over a 70-year lifetime.

To provide perspective on the meaning of these low values of probability and impacts, each will be examined separately and compared to a series of appropriate "benchmarks." These benchmarks are similar kinds of probabilities or impacts for which society is familiar, and which provide a set of references for comparing the estimated levels. These benchmarks are not used to provide any "acceptable risk" judgment, but to provide references to give meaning to the number in a relative sense.

Probabilities of accidents.--A summary of the probability and possible impact of accidental insecticide spills (aircraft and tank truck) is presented in Table 19. A listing of benchmarks for accident probabilities (annual individual risk for accidents leading to fatalities) is presented in Table 20. The probability of accidental insecticide spills do not necessarily lend directly to death in every case as shown, rather they can be considered probabilities of occurrence for incidents in which fatalities are possible. Table 20 is divided into two sections: involuntary risks and voluntary risks. The risks to the general public from an aircraft spill are involuntary risks. However, as demonstrated in this analysis, fatalities are not probable as a result of aircraft spills.

The risks associated with tank truck spills are voluntary risks since any potential exposure would be associated with spill containment by project personnel and not the general public. The voluntary risks described in Table 20 only provide reference values to more familiar accidents. In most cases, probabilities of injury, rather than death, is 10 to 100 times higher for cases in Table 19.

Benchmarks for impact.--The benchmarks for impact must address the probability of acute or chronic effects and cancer to an individual over a 70-year lifetime, rather than the annual frequency of occurrence. Table 21 provides a list of some benchmarks based on lifetime risk. Some of these are for cancer and disease, e.g., smoking or eating, while others are for accidents, e.g., driving or flying across the country. The comparison in the latter case implies that if the spill occurs, the risks to exposed people are, for example, similar to those risks incurred in flying across the country. Similarly, the cancer risks to MEI's exposed to carbaryl are much less than cancer risks associated with consumption of one can of diet soft drink containing saccharin. Again, no degree of acceptability is implied, only a perspective of the magnitude of the impact.

Table 1.--Probability of accidental tank truck and aircraft spills for a 100,000 acre/year project.

Insecticides	Number of Trips		Aircraft		Truck	
	Truck	Aircraft*	Water	Land	Water	Land
Acephate	25	167	9.5×10^{-3}	8.5×10^{-2}	2.6×10^{-5}	2.7×10^{-4}
Trichlorfon	34	222	1.3×10^{-2}	1.1×10^{-1}	4.1×10^{-5}	3.7×10^{-4}
Carbaryl	13	125	7.1×10^{-3}	6.3×10^{-2}	1.6×10^{-5}	1.4×10^{-4}
Diflubenzuron	50	333	1.9×10^{-2}	1.7×10^{-1}	6.0×10^{-5}	5.4×10^{-4}

*Assumes 300 gallons/flight.

Table 2.--Summary of base case doses by exposure scenario and insecticide.

Exposure Scenario	Base Case Dose (mg/kg)			
	Acephate 1/	Carbaryl 2/	Diflubenzuron 3/	Trichlorfon 2/
General Public				
Direct	0.0075	0.01	0.0006	0.01
Drift	0.0015	0.002	0.00012	0.002
Indirect	0.00068	0.0009	0.00005	0.0009
Direct and Environmental	0.0641	0.0855	0.0051	0.0855
Indirect and Environmental	0.0573	0.0764	0.0046	0.0764
Observer and Environmental	0.0784	0.1045	0.0063	0.1045
Occupational				
Mixers/loaders	0.075	0.100	0.006	0.100
Observers	0.022	0.029	0.0017	0.029
Accidents				
Aircraft Spill				
Dermal (partial)	27	35	2.1	35
Dermal (full)	40	53	3.2	53
Water (drinking)	0.017	0.023	0.0014	0.023
Truck Spill				
Dermal	974	2,596	38.9	974
Water (drinking)	0.227	0.604	0.0091	0.227

1/ Applied at the rate of 0.75 lbs active ingredient/acre.
2/ Applied at the rate of 1.0 lbs active ingredient/acre.
3/ Applied at the rate of 0.06 lbs active ingredient/acre.

Table 3.--Summary of established no observable effect levels (NOEL's) for acephate for selected organisms.

Animal	Type of Study	Effects Studied	NOEL	Reference 1/
Rat	90-day feeding	Inhibition of cholinesterase activity in plasma, red blood cells, and brain	5.0 ppm (0.25 mg/kg)	Fed Reg 47(227) 52994-52995, 24 November 1982
Dog	2-year feeding	Inhibition of cholinesterase activity in plasma, red blood cells, and brain	30.0 ppm (0.75 mg/kg)	Fed Reg 47(227) 52994-52995, 24 November 1982
Dog	2-year feeding	Systemic toxicity	100 ppm (2.5 mg/kg)	Fed Reg 47(227) 52994-52995, 24 November 1982
Rat	28-month feeding/ oncogenic	Inhibition of cholinesterase activity in plasma, red blood cells, and brain	5.0 ppm (0.25 mg/kg)	Fed Reg 47(227) 52994-52995, 24 November 1982
Rabbit	Teratogenic	Teratogenicity	10.0 mg/kg (highest dose tested)	Fed Reg 47(227) 52994-52995, 24 November 1982
Rat	Teratogenic	Teratogenicity	200 mg/kg (highest dose tested)	Fed Reg 47(227) 52994-52995, 24 November 1982
Rat	Neuro toxic	Leg paralysis	375 mg/kg	Fed Reg 47(227) 52994-52995, 24 November 1982

1/ See U.S. Environmental Protection Agency (1982) in References Cited.

Table 4.--Summary of established no observable effect levels (NOEL's) for carbaryl for selected organisms.

Animal	Type of Test	NOEL	Reference
Mouse	Teratogenic (birth defects)	5,660 ppm (150 mg/kg/day)	Murray, F.J., Staples, R.E., and Schwetz, B.A. 1979. Teratogentic potential of carbaryl given to rabbits and mice by gauage or by dietary inclusion. Toxico. Appl. Pharmacol. 51:81-89.
Rabbit	Teratogenic (birth defects)	5,660 ppm (150 mg/kg/day)	Murray, F.J., Staples, R.E., and Schwetz, B.A. 1979. Teratogentic potential of carbaryl given to rabbits and mice by gauage or by dietary inclusion. Toxico. Appl. Pharmacol. 51:81-89.
Rat	Teratogenic, but maternal weight loss observed	500 mg/kg/day	Weil, C.S., Woodside, M.D., Carpenter, C.P., and Smyth, H.P., Jr. 1972. Current status of tests of carbaryl for reproductive and teratogenic effect. Toxicol. Appl. Pharmacol. 14:409-419.
Guinea pig	Fetal effects	300 mg/kg/day	Weil, C.S., Woodside, M.D., Bernard, B., Conara, N.L., and Carpenter, C. P. 1973. Studies on rat reproduction and guinea pigs teratology of carbaryl fed either in the diet or by stomach. Toxicol. Appl. Pharmacol. 26:621-438.
Rabbit	Fetal toxicity Maternal toxicity	200 mg/kg/day	Robens, J.F. 1969. Teratologic studies of carbaryl, diazinon, norea, disulfiram, and thiram in small laboratory animals. Toxicol. Appl. Pharmacol. 15:152-168.
Dog	Teratogenic	2.0 mg/kg/day	U.S. Environmental Protection Agency 1980 Carbaryl decision document. 66 pp.

Table 4.--Summary of established no observable effect levels (NOEL's) for carbaryl for selected organisms - continued.

Animal	Type of Test	NOEL	Reference
Mouse	Dominant lethal	5.0 mg/kg/day	Epstein, S.S., E. Arnold, J. Andrea, W. Bass, & Y. Bishop. 1972. Detection of chemical mutagens by the dominant lethal assay in the mouse. Toxicol. Appl. Pharmacol. 23:288-325.

Table 5.--Summary of established no observable effect levels (NOEL's) for diflubenzuron for selected organisms.

Animal	Type of Test	NOEL	Reference
Rat	2-year feeding	40 mg/kg	Mulder, M.S., and Gijswijt, M.J. The laboratory evaluation of two promising new insecticides with interference with cuticle deposition. Pest Sci. 4:745, 1973.
Mouse	80-week feeding	50 mg/kg	Dimilin-25W. Uniroyal Technical Data Sheet. 3/83. 4 p.
Rat	3 generation	160 mg/kg	Dimilin-25W. Uniroyal Technical Data Sheet. 3/83. 4 p.
Rat	Teratogenic	4 mg/kg	McCann, J., and Ames, B. The salmonella/microsome mutagenicity test: predictive value for animal carciogenicity. In: Origins of human cancer. Hiatt, H.H., Watson, J.D., and Winstein, J.A. Cold Spring Harbor Conference on Cell Proliferation, 4(book C): 1431-1450. 1977.
Rabbit	Teratogenic	4 mg/kg	McCann, J., and Ames, B. The salmonella/microsome mutagenicity test: predictive value for animal carciogenicity. In: Origins of human cancer. Hiatt, H.H., Watson, J.D., and Winstein, J.A. Cold Spring Harbor Conference on Cell Proliferation, 4(book C): 1431-1450. 1977.

Table 5.--Summary of established no observable effect levels (NOEL's) for diflubenzuron for selected organisms - continued.

Animal	Type of Test	NOEL	Reference
	Mutagenic	1000-2000 mg/kg	Macgregor, J.T., D.H. Gould, Ann D. Mitchell and G.P. Sterling. 1979. Mutagenicity tests of diflubenzuron in the micronucleus test in mice, the L5178Y mouse lymphoma forward mutation assay, and the Ames Salmonella reverse mutation test. Mutation Research 66: 45-53.
Rat	Oncogenic	Inconclusive test results	

Table 6.--Summary of established no observable effect levels (NOEL's) for trichlorfon for selected organisms.

Animal	Type of Test	NOEL	Reference
Sheep	Toxic	200 mg/kg	Radeloff and Woodward[1/]
Cattle	Toxic	100 mg/kg	Radeloff and Woodward[1/]
Calves	Toxic	10 mg/kg	Radeloff and Woodward[1/]
Dog	Decreases acetyl-cholinesterase	500 mg/kg	Marsh, et al.[1/]
Dog	Modification of intestinal fermentic function	100 mg/kg	Gheorghien, 1967[1/]
Young dog	Reduces acetyl-cholinesterase activity	1 mg/kg	Jivogliadova, 1970[1/]
Rat	Reduces citochrom-oxydase activity	57 mg/kg	Jdanovici and Udalov, 1970[1/]
Rat	Modification of vitamin content	30 mg/kg	Nijegoro and Kalinon, 1968[1/]
Rat	Modifies immuno-biological responses	20 mg/kg	Olefir, 1971[1/]
Rat	Teratogenic embryotoxic	8 mg/kg	Marston, L.V., and V.M. Varonina. 1976. Experimental study of the effect of a series of phosphoroorganic pesticides (Dipterex and Imidan) on embryogenesis. Environ. Health Perspect. 13:121-125.

Table 6.--Summary of established no observable effect levels (NOEL's) for trichlorfon for selected organisms - continued.

Animal	Type of Test	NOEL	Reference
Mice	Mutagenic	19.25 mg/kg	Becker, J., and J. Schoneich, Zentralinstitut fur Genetik und Kulturpflanzenforschungder AdW der DDR, 4325 Gatersleben (German Democratic Republic).
Rat (male)	3-month to 2-year feeding study	2.5 mg/kg	Gaines, T.B. Acute toxicity of pesticides. Tox. Appl. Pharm 14(3)515-534, 1969.* As listed by Murphy, S.D., Dovll, J., Klaaseen, C.D., Amdur MO(Eds): Casarett and Dovll's Toxicology, 2d Ed. New York: MacMillan Publishing Company, Inc. 1980.
Dog	3-month to 2-year feeding study	1.25 mg/kg	Gaines, T.B. Acute toxicity of pesticides. Tox. Appl. Pharm 14(3)515-534, 1969.* As listed by Murphy, S.D., Dovll, J., Klaaseen, C.D., Amdur MO(Eds): Casarett and Dovll's Toxicology, 2d Ed. New York: MacMillan Publishing Company, Inc. 1980.
Hamster	Teratogenic	200 mg/kg	Staples, R.E., Goulding, E.H. Dipterex teratogenicity in the rat, hamster, and mouse when given by gauage. Environmental Health Perspective 30:105-113, 1979.

1/ Referenced in Zamfir G., Apostol S., Filipuc M: Researches on dipterex in view of establishing the allowable maximum concentration. Environmental Quality and Safety Supplement. Vol. III. Pesticides, pp. 845-849, (ca.) 1975).

Table 7.--Summary of established exposure thresholds and carcinogenic potency slopes used in the analysis.

Threshold	Acephate	Trichlorfon	Carbaryl	Diflubenzuron
Acute oral LD_{50} (lowest) mg/kg	866	150	500	> 4,640
NOEL (lowest) mg/kg	0.25 (cholinesterase inhibition)	1.0 (cholinesterase inhibition)	2.0 (teratogenic -dogs)	4.0 (teratogenic)
(next lowest) mg/kg	2.5 (systemic toxicity)	1.25 (systemic toxicity)	50.0 (mutagenicity)	40 (birth weight)
TLV (short-term exposure) mg/kg/day	0.70	0.28	0.28	0.70
ADI (long-term exposure) mg/kg/day	0.025	0.01	0.01	0.025*
Carcinogenic potency q_1 (mg/kg/day)	None	0.0511	0.045 (N-nitrosocarbaryl)	None

*EPA has not set an ADI; however, a tolerance level of 0.05 mg/kg has been established for eggs, meat products, milk, and poultry. Assuming an individual consumes 0.5 kg of food/day, estimated ADI would be 0.025 mg/kg.

Table 8.--Comparison of expected doses to established exposure thresholds for acephate.

Exposure Scenario	Expected Dose		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
General Public				
Direct	0.0083	0.012	Below ADI, TLV, NOEL	No Effects
Drift	0.0017	0.0025	Below ADI, TLV, NOEL	No Effects
Indirect	0.0008	0.0011	Below ADI, TLV, NOEL	No Effects
Direct and Environmental	0.0705	0.1058	Below NOEL, TLV Above ADI	No Effects
Indirect and Environmental	0.0630	0.0945	Below NOEL, TLV Above ADI	No Effects
Observer and Environmental	0.089	0.134	Below NOEL, TLV Above ADI	No Effects
Occupational				
Mixers/Loaders	0.083	0.124	Below NOEL, TLV	No Effects
Observers	0.024	0.036	Below NOEL, TLV	No Effects
Accidents				
Aircraft Spill				
Dermal (partial)	30	45	Below LD_{50}	Possible symptoms of cholinesterase inhibition
Dermal (full)	44	66	Below LD_{50}	Possible symptoms of cholinesterase inhibition

Table 8.--Comparison of expected doses to established exposure thresholds for acephate - continued.

Exposure Scenario	Expected Dose		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Water (drinking)	0.019	0.028	Above ADI (worst case) Below NOEL	No Effects
Truck Spill				
Dermal	1,071	1,607	Above LD_{50}	Acute Toxicity expected
Water (drinking)	0.249	0.374	Below NOEL (realistic case), Above lowest NOEL (worst case dose)	No effect, cholinesterase inhibition possible

Table 9.--Comparison of expected doses to established exposure thresholds for carbaryl.

Exposure Scenario	Expected Dose		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
General Public				
Direct	0.011	0.017	Below TLV, NOEL Above ADI	No Effect
Drift	0.0022	0.0033	Below TLV, NOEL, ADI	No Effect
Indirect	0.0010	0.0015	Below TLV, NOEL, ADI	No Effect
Direct and Environmental	0.0941	0.1411	Below TLV, NOEL Above ADI	No Effect
Indirect and Environmental	0.0840	0.1261	Below TLV, NOEL Above ADI	No Effect
Observer and Environmental	0.1149	0.1724	Above ADI Below NOEL, TLV	No effect
Occupational				
Mixers/Loaders	0.11	0.165	Below TLV, NOEL	No Effect
Observers	0.032	0.048	Below TLV, NOEL	No Effect
Accidents				
Aircraft Spill				
Dermal (partial)	39	58	Below Acute LD_{50}	Possible symptoms of cholinesterase inhibition
Dermal (full)	58	87	Below Acute LD_{50}	Possible symptoms of cholinesterase inhibition

Table 9.--Comparison of expected doses to established exposure thresholds for carbaryl - continued.

Exposure Scenario	Expected Dose		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Water (drinking)	0.025	0.038	Above ADI Below TLV, NOEL	No Effect
Truck Spill Dermal	2,596	2,596	Above LD_{50}	Acute effects expected for unprotected workers
Water (drinking)	0.604	0.604	Above ADI, TLV Below NOEL	No Effect expected

Table 10.--Comparison of expected doses to established exposure thresholds for diflubenzuron.

Exposure Scenario	Expected Dose		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
General Public				
Direct	0.00066	0.00099	Below ADI, TLV, NOEL	No Effect
Drift	0.00013	0.00020	Below ADI, TLV, NOEL	No Effect
Indirect	0.00006	0.00009	Below ADI, TLV, NOEL	No Effect
Direct and Environmental	0.0056	0.0084	Below ADI, TLV, NOEL	No Effect
Indirect and Environmental	0.0051	0.0076	Below ADI, TLV, NOEL	No Effect
Observer and Environmental	0.0069	0.0104	Below ADI, TLV, NOEL	No Effects
Occupational				
Mixers/Loaders	0.0066	0.0099	Below ADI, TLV, NOEL	No Effect
Observers	0.0019	0.0028	Below ADI, TLV, NOEL	No Effect
Accidents				
Aircraft Spill				
Dermal (partial)	2.3	3.5	Below Acute LD_{50}	No acute effect
Dermal (full)	3.5	5.3	Below Acute LD_{50}	No acute effect
Water (drinking)	0.0015	0.0023	Below ADI, TLV, NOEL	No Effect
Truck Spill				
Dermal	43	64	Below Acute LD_{50}	No acute effect
Water (drinking)	0.010	0.015	Above ADI, Below TLV, NOEL	No Effect

Table 11.--Comparison of expected doses to established exposure thresholds for trichlorfon.

Exposure Scenario	Expected Dose: Realistic	Expected Dose: Worst Case	Comparison to Established Exposure Thresholds	Analysis
General Public				
Direct	0.011	0.017	Below TLV, NOEL Above ADI	No Effect
Drift	0.0022	0.0033	Below TLV, NOEL, ADI	No Effect
Indirect	0.001	0.0015	Below TLV, NOEL, ADI	No Effect
Direct and Environmental	0.0941	0.1411	Below TLV, NOEL Above ADI	No Effect
Indirect and Environmental	0.0840	0.1261	Below TLV, NOEL Above ADI	No Effect
Observer and Environmental	0.1149	0.1724	Below TLV, NOEL Above ADI	No Effect
Occupational				
Mixers/Loaders	0.11	0.17	Below TLV, NOEL	No Effect
Observers	0.032	0.048	Below TLV, NOEL	No Effect
Accidents				
Aircraft Spill				
Dermal (partial)	39	58	Below Acute LD_{50}	Possible cholinesterase inhibition
Dermal (full)	58	87	Below Acute LD_{50}	Possible cholinesterase inhibition
Water (drinking)	0.025	0.025	Below NOEL, TLV, ADI	No Effect
Truck Spill				
Dermal	974	974	Above LD_{50}	Acute effects expected
Water (drinking)	0.227	0.227	Below NOEL, TLV Above ADI	No Effect

Table 12.--Summary of exposure scenarios by insecticide where effects are possible.

ACEPHATE

Scenario	Possible Effects of Incident	Probability of occurrence	Potential Number of people exposed to Incident
Aircraft Spill			
Dermal (partial)	Temporary cholinesterase inhibition	5.1×10^{-4}	3.5 general public 1/
Dermal (partial)	Temporary cholinesterase inhibition		3.5 general public 1/
Truck Spills			
Dermal	Actue effects. Possible fatalities if protective clothing not used	1.08×10^{-5}	2 workers 2/
Water (drinking)	Possible inhibition of cholinesterase activity (worst case only)	1.2×10^{-6}	All who drink the water

CARBARYL

Scenario	Possible Effects of Incident	Probability of occurrence	Potential Number of people exposed to Incident
Aircraft Spill			
Dermal (partial)	Temporary decreased cholinesterase activity	5.1×10^{-4}	3.5 general public
Dermal (partial)	Temporary decreased cholinesterase activity	5.1×10^{-4}	3.5 general public
Truck Spills			
Dermal	Actue effects. Possible fatalities if protective clothing not used	1.08×10^{-5}	2 workers

Table 12.--Summary of exposure scenarios by insecticide where effects are possible - continued.

DIFLUBENZURON

Scenario	Possible Effects of Incident	Probability of occurrence	Potential Number of people exposed to Incident
General Public			
All scenarios	None	--	--
Occupational			
All exposure scenarios	None	--	--
Accidents			
All exposure scenarios	None	--	--

TRICHLORFON

Scenario	Possible Effects of Incident	Probability of occurrence	Potential Number of people exposed to Incident
Aircraft Spill			
Dermal (partial)	Temporary cholinesterase inhibition - possible acute effects for worst case dose	5.1×10^{-4}	3.5 general public
Dermal (partial)	Possible fatalities for worst case dose - possible acute toxicity for realistic dose	5.1×10^{-4}	3.5 general public
Truck Spills			
Dermal	Possible acute effects for realistic dose - Possible fatalities for worst case dose	1.08×10^{-5}	2 workers

1/ Exposed population = (14 people/acre) x 0.25 acres/spill.
2/ Assumption for number of workers containing the spill.

Table 13.--Comparison of calculated doses (10x) for sensitive populations to established exposure thresholds for acephate.

Exposure Scenario	Calculated Dose (10x)		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Direct	0.083	0.12	Below NOEL, TLV	No effects expected
Drift	0.017	0.025	Below NOEL, TLV, ADI	No effects expected
Indirect	0.008	0.011	Below NOEL, TLV, ADI	No effects expected
Direct and Environmental	0.75	1.058	Above ADI, TLV, and lowest NOEL Below second lowest NOEL	Temporary effects possible
Indirect and Environmental	0.630	0.945	Above ADI, TLV (worst case) and lowest NOEL Below second lowest NOEL	Temporary effects possible
Observer and Environmental	0.862	1.294	Above ADI, TLV, lowest NOEL Below second lowest NOEL	Temporary effects possible

Table 14.--Comparison of calculated doses (10x) for sensitive populations to established exposure thresholds for carbaryl.

Exposure Scenario	Calculated Dose (10x)		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Direct	0.11	0.17	Above ADI Below TLV, NOEL	No effects expected
Drift	0.022	0.033	Above ADI Below TLV, NOEL	No effects expected
Indirect	0.01	0.015	Above ADI Below TLV, NOEL	No effects expected
Direct and Environmental	0.941	1.411	Above ADI, TLV Below NOEL	No effects expected
Indirect and Environmental	0.840	1.261	Above ADI, TLV Below NOEL	No effects expected
Observer and Environmental	1.149	1.724	Above ADI, TLV Below NOEL	No effects expected

Table 15.--Comparison of calculated doses (10x) for sensitive populations to established exposure thresholds for diflubenzuron.

Exposure Scenario	Calculated Dose (10x)		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Direct	0.0066	0.0099	Below NOEL, TLV, ADI	No effect
Drift	0.0013	0.0020	Below NOEL, TLV, ADI	No effect
Indirect	0.0006	0.0009	Below NOEL, TLV, ADI	No effect
Direct and Environmental	0.056	0.084	Below NOEL, TLV Above ADI	No effect
Indirect and Environmental	0.051	0.076	Below NOEL, TLV Above ADI	No effect
Observer and Environmental	0.069	0.104	Below NOEL, TLV Above ADI	No effect

Table 16.--Comparison of calculated doses (10x) for sensitive populations to established exposure thresholds for trichlorfon.

Exposure Scenario	Calculated Dose (10x)		Comparison to Established Exposure Thresholds	Analysis
	Realistic	Worst Case		
Direct	0.11	0.17	Above ADI Below NOEL, TLV	No effect
Drift	0.022	0.033	Above ADI Below NOEL, TLV	No effect
Indirect	0.01	0.015	Above ADI Below NOEL, TLV	No effect
Direct and Environmental	0.941	1.411	Above ADI, TLV Worst case above NOEL	Possible effects for worst case only
Indirect and Environmental	0.840	1.261	Above ADI, TLV Worst case above NOEL	Possible effects for worst case only
Observer and Environmental	1.149	1.724	Above ADI, TLV, NOEL	Possible effects for realistic and worst cases

Table 17.--Summary of general public exposure scenarios for sensitive populations where effects are possible.

Insecticide/scenario	Possible Effects 1/	Probability of Occurrence
Acephate		
Direct and Environmental	Temporary decrease in cholinesterase activity	1.0
Indirect and Environmental	Temporary decrease in cholinesterase activity	1.0
Observer and Environmental	Temporary decrease in cholinesterase activity	1.0
Carbaryl		
All scenarios	None	1.0
Diflubenzuron		
All scenarios	None	1.0
Trichlorfon		
Direct and environmental	Reduction in 2/ cholinesterase activity	0.0087
Indirect and environmental	Reduction in 2/ cholinesterase activity	0.0087
Observer and environmental	Reduction in cholinesterase activity	1.0

1/ Realistic and worst case dose except where noted.
2/ Worst case dose only.

Table 18.--Probability of cancer to the maximum exposed individuals (MEI) in a 70-year lifetime from exposure to carbaryl and trichlofon as used in gypsy moth suppression and eradication projects.

Maximum Exposed Individuals	Realistic Dose (mg/kg/day)	Estimated lifetime cancer risk (Realistic)		Worst Case Dose (mg/kg/day)	Estimated lifetime cancer risk (Worst case)	
		Suppression	Eradication		Suppression	Eradication
Carbaryl/Nitrosocarbaryl						
Observer and Environmental	0.115	4.05×10^{-9}	2.43×10^{-9}	0.172	6.06×10^{-9}	3.63×10^{-9}
Direct and Environmental	0.094	3.31×10^{-9}	1.99×10^{-9}	0.141	4.96×10^{-9}	2.98×10^{-9}
Trichlorfon						
Observer and Environmental	0.115	2.30×10^{-6}	1.38×10^{-6}	0.172	3.44×10^{-6}	2.06 x 10-6
Direct and Environmental	0.094	1.88×10^{-6}	1.13×10^{-6}	0.141	2.82×10^{-6}	1.69×10^{-6}

Table 19.--Summary of accident probabilities and impacts.

Probability/ Impact	Acephate	Carbaryl	Diflubenzuron	Trichlorfon
<u>Probability</u>				
Truck				
Land	$\underline{2.7 \times 10^{-4}}$	$\underline{1.4 \times 10^{-4}}$	5.4×10^{-4}	$\underline{3.7 \times 10^{-4}}$
Water	2.6×10^{-5}	1.6×10^{-5}	6.0×10^{-5}	4.1×10^{-5}
Aircraft				
Land	8.5×10^{-2}	6.3×10^{-2}	1.7×10^{-1}	1.1×10^{-1}**
Water	9.5×10^{-3}	7.1×10^{-3}	1.9×10^{-2}	6.3×10^{-2}
<u>Dose</u>				
Truck				
Land	$\underline{1{,}607}$	$\underline{2{,}596}$ mg/kg	64 mg/kg	$\underline{974}$
Water	0.374	0.604 mg/kg	0.015 mg/kg	0.227
Aircraft				
Land	66 mg/kg	87 mg/kg	5.3 mg/kg	87 mg/kg**
Water	0.028 mg/kg	0.038 mg/kg	0.0023 mg/kg	0.025
LD_{50}	866	500	4,640	150

* Underlining denotes the probability of accidents where the dose is higher than the LD_{50} and fatalities are possible.

** Probability is shown for one case where the dose is below the LD_{50}, but relatively close to it.

Table 20.--Benchmarks for accident probabilities
(annual individual risk for accidents leading to fatalities*)

Condition	Probability of Death Individual per Year
A. Involuntary Risks**	
Motor vehicle-pedestrian death	4.3×10^{-5}
Train-pedestrian death	3.2×10^{-7}
Train-motor vehicle	3.3×10^{-6}
Falls in public places	1.9×10^{-6}
Falls in the home	3.2×10^{-5}
Fires in the home	2.1×10^{-6}
Poisoning-solids and liquids	1.2×10^{-5}
Poisoning-gases and vapors	5.0×10^{-6}
Suffocation-ingested object	9.0×10^{-6}
Suffocation-mechanized	2.0×10^{-6}
Firearms-accidental	5.0×10^{-6}
Lightning (1977)	5.3×10^{-7}
Bites and stings of venomous insects and animals	2.5×10^{-7}
B. Voluntary Risks	
All accidents	4.7×10^{-4}
Motor vehicle accidents	2.4×10^{-4}
Drowning	3.0×10^{-5}
Bicycle	1.0×10^{-5}
Air transport-passengers	6.0×10^{-6}
Railroad	2.0×10^{-6}

* Data is from Accident Facts - 1980 Edition, National Safety Council, Chicago, Illinois, for 1979 unless otherwise noted.

** Some of these risks are not strictly involuntary and often the data are mixed among both types.

Table 21.--Lifetime risks in individual actions if committed.

Individual Action	Lifetime Increase in Death 10^{-6}	Basis for Risk
Smoking a cigarette	0.7	Cancer, Heart disease
Calorie-rich dessert	3.5	Obesity-sugar and cholesterol
Nondiet soft drink	2.0	Obesity-sugar
Diet soft drink	.01	Cancer caused by saccharin
Crossing a street	.02	Accident
Extra driving	.02/mile	Accident
Not fastening seat belt	.005/mile	Accident consequence
1 mrem of radiation	0.1	Cancer caused by radiation
Coast-to-coast drive	70	Accident
Coast-to-coast flight	7	Accident
Skipping annual PAP test	420	Cancer-cervix
Buying a small car	450	Accident increase
Choose Vietnam Army duty	42,000	War
Living 20 years near a PVC plant	1.0	Cancer from vinyl chloride

*One in a million increase in chance of death over one's whole life.

REFERENCES CITED

Back, R.C. 1961. Memo summarizing surface residues on forest foliage. Union Carbide Corp.

Barry, J.W., R.B. Ekblad, P.A. Kenney, and L.A. Barber. 1983. Drift from aerial application to coniferous seed orchards. USDA For. Serv., Unpubl. rept. Davis, CA. 8 p.

Becker, J., and J. Schoneich, Zentralinstitut fur Genetik und Kulturpflanzenforschungder AdW der DDR, 4325 Gatersleben (German Democratic Republic).

Dedek, W., H. Scheufler, G.W. Fischer. 1975. The mutagenicity of Desmethyltrichlorphone in Dominant Lethal Test on Mice. Arch. Toxicol. 33:163-168.

Dimilin-25W. Uniroyal Technical Data Sheet. 3/83. 4 p.

Eisenbrand, G, O. Ungerer, and R. Pruessman. 1975. The reaction of nitrate with pesticides. II. Formation. Chemical properties and carcinogenic activity of the N-nitroso derivative of N-methyl-1-naphthyl carbamate (carbaryl). Food Cosmet. Toxicol. 13:365-367.

Epstein, S.S., E. Arnold, J. Andrea, W. Bass, and Y. Bishop. 1972. Detection of chemical mutagens by the dominant lethal assay in the mouse. Toxicol. Appl. Pharmacol. 23:288-325.

Fishbein, L. 1978. Overview of potential mutagenic problems posed by some pesticides and their trace impurities. Environ. Health Perspectives Vol. 27, pp. 125-131.

Gaines, T.B. Acute toxicity of pesticides. 1969. Toxicol. Appl. Pharmacol. 14(3)515-534,* As listed by Murphy, S.D., Dovll, J., Klaaseen, C.D., Amdur MO(Eds.): Casarett and Dovll's Toxicology, 2d Ed., New York: MacMillan Publishing Company, Inc. 1980.

Ghassemi, Masood, P. Painter, M. Powers, N.B. Akesson, and M. Dellarco. 1982. Estimating drift and exposure due to aerial application of insecticides in forests. Environ. Sci. Technol. 16:510-514.

Ghassemi, Masood, Linda Fargo, Page Painter, Pam Painter, Sandra Quinliuan, Robert Scofield, and Anne Takata. 1981. Environmental fates and impacts of major forest use pesticides. Prepared for: U.S. Environmental Protection Agency. Available from the National Technical Information Service, Washington, D.C.

Lavy, T.L., and J.D. Mattice. 1984. Monitoring human exposure during pesticide application in the forest. In "Chemical and Biological Controls in Forestry". W.Y. Garner and J. Harvey Eds. ACS Symposium Series 238. American Chemical Society, Washington, DC.

Lavy, T. L., J.D. Mattice, R.R. Fynn, and M. Davis. 1982. Limiting application exposure to pesticides. World of Ag. Aviat. March 1982. p. 33-37.

Lehman, A.J. 1959. Appraisal of the safety of chemicals in food, drugs, and cosmetics. Assoc. Food and Drug Officials U.S.

Leng, M.L., J.C. Ramsey, W.H. Braun, and T.L. Lavy. 1982. Review of studies with 2, 4, 5-trichlorophenoxyacetic acid in humans including applicators under field conditions. In "Pesticide Residues and Exposure." J.R. Plimmer, ed. ACS Symposium Series 182. Americal Chemical Society, Washington, DC.

Macgregor, J.T., D.H. Gould, Ann D. Mitchell and G.P. Sterling. 1979. Mutagenicity tests of diflubenzuron in the micronucleus test in mice, the L5178Y mouse lymphoma forward mutation assay, and the Ames Salmonella reverse mutation test. Mutation Research 66: 45-53.

Maitlen, J.C., C.R. Sell, L.M. McDonough, and S.N. Fertig. 1982. Workers in the agricultural environment: dermal exposure to carbaryl. In ACS Symposium 182. American Chemical Society, Washington, DC.

Maksymiuk, B., and R.D. Orchard. 1975. Distribution of aerially applied Bacillus thuringiensis for controlling insects in a hardwood forest. USDA For. Serv. Res. Pap. PNW-246, 12P.

Mantel, N., and M.A. Schneiderman. 1975. Estimating "safe levels", a hazardous undertaking. Cancer Research Line 35:1379.

Marston, L.V., and V.M. Varonina. 1976. Experimental study of the effect of a series of phosphoroorganic pesticides (Dipterex and Imidan) on embryogenesis. Environmental Health Perspective. 13:121-125.

McCann, J., and B. Ames. 1977. The salmonella/microsome mutagenicity test: predictive value for animal carciogenicity. In: Origins of human cancer. Hiatt, H.H., Watson, J.D., and Winstein, J.A. Cold Spring Harbor Conference on Cell Proliferation, 4(book C): 1431-1450.

Mulder, M.S., and M.J. Gijswijt. 1973. The laboratory evaluation of two promising new insecticides with interference with cuticle deposition. Pest Sci. 4:745.

Murray, F.J., R.E., Staples, and B.A. Schwetz. 1979. Teratogentic potential of carbaryl given to rabbits and mice by gavage or by dietary inclusion. Toxico. Appl. Pharmacol. 51:81-89.

Neisess, J., G.P. Markin, and R. Schaefer. 1976. Field evaluations of acephate and Dimilin against the Douglas-fir tussock moth. J. Econ. Entomol. 69:783-786.

Newton, M., and F.N. Dost. 1981. Environmental effects of vegetation management practices on DNR forest lands. State of Washington, Department of Natural Resources.

Orchard, R.D., J. Neisess, J. Mounts, and G.P. Markin. 1974. Evaluation of the Bell 205A-1 turbojet helicopter and spray system for forest application of insecticide. USDA For. Serv. Res. Note PNW-224. 23 p.

Patel, Y.M. and J.A. Santolucito. 1980. Selected toxicological studies in weanling male rats. Env. Monit. Sys. Lab Report EPA 600/3-80-031. 18 p.

Preussmann, R. Direct alkylating agents as carcinogens. Forschergruppe Praeventiumedizen am Max Planck Institut fur Immunbiologie, 78 Freiburg, Stefan-Meierstr. 8, Germany.

Quarles, J.M. 1980. Absence of transformation by diflubenzuron in a host medicated transplacental carcinogen assay. Bull. Env. Contam. and Toxicol. 25(2):252-256.

Robens, J.F. 1969. Teratologic studies of carbaryl, diazinon, norea, disulfiram, and thiram in small laboratory animals. Toxicol. Appl. Pharmacol. 15:152-168.

Schooley, D.A., and G.B. Quistad. 1979. Metabolism of insect growth regulators in aquatic organisms. ACS Symposium Series 99:161-176.

Schulze, T.L. 1979. Assessment of human exposure to carbaryl during aerial application for gypsy moth control in New Jersey. Unpubl. report submitted to EPA, April 11, 1979.

Seiler, J.P. 1977. Nitrosation in vitro and in vivo by sodium nitrite and mutagenicity of nitrogenous pesticides. Mutation Research. 48:225-236.

South Carolina Epidemiologic Studies Center. 1978. Measure of exposure to the carbamate carbaryl: Maine carbaryl study, 1978. Draft 1978 Interim report, Medical University of South Carolina, March 1979.

South Carolina Epidemiologic Studies Center. 1979. Measure of exposure to the carbamate carbaryl: Maine carbaryl study, 1979. Draft interim report, Medical University of South Carolina, November 1979.

Staples, R.E., Goulding, E.H. 1979. Dipterex teratogenicity in the rat, hamster, and mouse when given by gavage. Environmental Health Perspective. 30:105-113.

Thedeen, T. 1979. The problem of quantifications in energy risk management, Rowe and Goudman (Ed.). Acedemic Press, London.

U.S. Environmental Protection Agency. 1982. Pesticide Registration; Proposed Data Requirements. 47 FR 53192-

U.S. Environmental Protection Agency. 1982. Acephate, tolerances. Federal Register. 47(227):52994-5.

U.S. Environmental Protection Agency 1980 Carbaryl decision document. 66 pp.

USDA Forest Service. 1984. Western spruce budworm management in northeastern Oregon. Environmental Assessment. Pacific Northwest Region. Portland, Oregon.

USDA Forest Service. 1983. Critique of 1983 western spruce budworm control project. Forest Pest Mgt. Rept., Pacific Northwest Region, Portland Oregon.

Weil, C.S., M.D. Woodside, B. Bernard, N.L. Conara, and C.P. Carpenter. 1973. Studies on rat reproduction and guinea pigs teratology of carbaryl fed either in the diet or by stomach. Toxicol. Appl. Pharmacol. 26:621-438.

Weil, C.S., M.D. Woodside, C.P. Carpenter, and H.P. Smyth, Jr. 1972. Current status of tests of carbaryl for reproductive and teratogenic effect. Toxicol. Appl. Pharmacol. 14:409-419.

Witt, J.M. 1984. Pesticide drift: toxicological and social consequences. ACS Sumposium Series 238.

Zamfir G., S. Apostol, M. Filipuc. Researches on view of establishing the allowable maximum . Environmental Quality and Safety Supplement on Pesticides, 845-849, (ca. 1975).

APPENDIX G

DRAFT EIS COMMENT LETTERS AND RESPONSES

Draft EIS Comments Letters and Responses

Introduction

Comment letters on the DEIS were received from 45 individuals, agencies, or organizations. Seven comment letters were received after close of business on February 27, too late to be responded to in the FEIS. However, these late comments are included in the FEIS and will be considered in the final decision-making process. Of the 38 comment letters received on time, 2 requested extension of the comment period. As noted in the response to comments, both requests were denied since granting an extension would have delayed the decision-making process beyond time when any action to be taken would have to be implemented.

All of the comment letters are numbered on the upper right corner. Each substantive comment that was considered and addressed is identified by an alphabetical letter located on the right side of the letter.

Responses to timely comment letters received are as follows:

Letter	Comments	Response
1		No response required.
2		No response required.
3	a	Your reference deleted. New reference added.
	b	Comment noted. See changes on page 17 and 19 of FEIS.
4		Extension denied.
5		The USDA - Gypsy Moth Working Group provides the mechanism through which gypsy moth activities are coordinated on a national basis.
6		No response required.
7	a	The State activities will be addressed in site-specific environmental analyses.
	b	The preferred alternative is identified on the cover page, page iii, 15, and page 21.

Letter	Comments	Response
	c	This is beyond the scope of the NEPA process. Technical assistance to large private forest landowners is available from State agencies with forestry or gypsy moth responsibilities. In Pennsylvania, the Department of Natural Resources should be contacted.
	d	Copies were sent.
8		We agree with these suggestions. See pages 12-14 and the discussion of IPM on page 69 of the FEIS.
9		No response required.
10	a	As mentioned on page 61 of the EIS, the USDA is encouraged by the results of recent operational use of <u>B. t.</u> as an eradication tool. However, based on this limited data, we feel it would be premature at this time to designate <u>B. t.</u> as the preferred alternative for eradication projects. Forcing its use in situations where it could likely fail may significantly set back the progress made in developing this material for eradication projects. For this reason, we feel it should only be used in situations where certain criteria are met, i.e. 1) good base-line gypsy moth population data based on at least one season's pheromone delimiting trapping, and 2) extremely low egg mass densities (preferably less than 10 per acre).
	b	We have no efficacy data to support spot ground applications with <u>B. t.</u> as an adjunct to broader scale aerial application. Where new technology or approaches are being developed, it should be done on the basis of site-specific assessments of risks associated with a lack of efficacy data regarding these new approaches.

Letter	Comments	Response
	c	We agree that IPM has the potential, where proven technology is utilized, to be highly efficacious even without the use of chemical pesticides. We may be approaching that "state-of-the art" in dealing with isolated gypsy moth infestations. The Final EIS has been changed to reflect this.
11		No response required.
12		No response required.
13	a	Defoliation surveys have been standardized and are comparable from year to year.
	b	The unit of measurements is acres. The table has been changed to reflect this.
	c	The economic data presented apply only to areas that have been infested by gypsy moth. The 2.2 million acres surveyed in Pennsylvania include only areas with a repeated history of gypsy moth defoliation.
	d	Use of chemical insecticides for gypsy moth suppression has been effective in meeting project goals, i.e. foliage protection, population reduction, and prevention of tree mortality in high value areas. The "problem" continues since historically, less than 10 percent of the defoliated area has been treated in any one year. The treatment objective is to reduce impact in localized areas, not to eliminate the problem.
	e	This would appear to duplicate activities carried out under the authorities of other State and Federal agencies.
	f	Human health risks are addressed in Appendix F (Risk Assessment with Worst Case Assumptions) (RA/WCA). Parasite and predator management alone have not proven efficacious, especially at population levels where it is necessary to use chemical insecticides.

Letter	Comments	Response
	g	Residual exposure is addressed in Appendix F (RA/WCA).
14		Extension denied.
15		Cooperative State agencies work closely with State and county extension agents in the area of communication.
16	a	The FEIS has been updated to incorporate new information on efficacy of B. t., and in response to recent court decisions relative to the adequacy of the 1981 EIS.
	b	The 1981 EIS did discuss eradication. For example, see pages i, iii, 1, 2, and 10.
	c	This will be addressed in annual site-specific environmental assessments for both suppression and eradication projects.
	d	States that obtain Federal financial assistance are required to follow all requirements of NEPA and FIFRA. The USDA cannot provide financial assistance to States that do not comply with both acts. Additionally, States must follow applicable State laws.
	e	The estimated loss represents a theoretical value based on prevailing stumpage prices for the New Jersey area. However, New Jersey Forestry was successful in having some of the timber mortality salvaged at reduced values.
	f	See Appendix E for history of eradication. Criteria for participating in eradication projects are discussed on pages 13 and 14 of the FEIS. This is an expansion of the material contained in the DEIS.

Letter	Comments	Response
	g	Projection of defoliation is beyond the ability of the current state-of-the-art. APHIS has made projections regarding spread to new areas, but not relative to the alternatives as discussed in this EIS. These projection are contained in an APHIS report entitled "An Economic and Operational Analysis of the APHIS gypsy moth program", September 1982. Copies of this report are available upon request.
	h	The effect of no action would be to allow unacceptable hardwood losses to occur and the Forest Service would not meet their statutory obligation. See p. 13(2) of FEIS. APHIS would be faced with regulating an ever increasing number of areas outside the generally infested portions of the U. S. This would directly impact the agencies allocation of resources, i.e. dollars and manpower. Further discussion is contained on pages 35 and 36 of the FEIS.
	i	Information on nontarget insect effects of the various insecticides as found in Table 2, page 18 of the FEIS is deemed sufficient to meet the requirements of NEPA. Mitigation measures relative to honey bees are discussed on page 46 of the FEIS. Further mitigation measures are addressed in site-specific environmental assessments as necessary.
	j	Special environmental concerns could be the presence of water, chemically sensitive individuals, or nontarget organisms. Where eradication is the project goal, two applications of a chemical insecticide have given the most consistent results. Your partial quote on effectiveness omits an important aspect of the sentence in the middle paragraph on page 21. The statements you cite are not in conflict.

Letter	Comments	Response
	k	Such areas generally would not meet the gypsy moth population level criteria for suppression; however, a regulatory situation involving nursery stock or Christmas trees could require treatment to prevent artificial spread of the insect.
	l	On Federal lands and in situations involving eradication treatments, the public is not generally involved in the selection of specific treatment areas. They may be involved, however, in discussion of other aspects of the treatment plans such as the selection of treatment materials and/or mitigating measures. This can be accomplished by soliciting public comment or through public meetings.
	m	Proper pesticide safety precautions as specified on pesticide labels are followed. Plans for handling pesticide spills, worker exposure, etc., are covered in site-specific environmental assessments and other agency guidelines.
	n	For those areas that meet the State criteria for suppression, and based on information provided at local public meetings, individuals decide for or against treatment of their property.
	o	See page 13 of the FEIS for eradication project criteria. Suppression projects only take place in the generally infested area.
	p	Because of the high level of cooperator compliance, requiring this is not felt necessary.

Letter	Comments	Response
	q	The minimum selection criteria for Federal land is the same as for State and private lands. However, the decision to take action on Federal lands is the responsibility of the Federal land manager or other designated official. The minimum selection criteria for APHIS eradication projects are the same for Federal as well as for State and private lands. This change is reflected in the text of the final EIS.
	r	This is the responsibility of EPA under FIFRA. Some States have similar State laws. In practice this guideline is rigidly adhered to.
	s	Insecticides are applied above 80°F only when it can be determined that they are reaching the target area.
	t	Yes, if the State project involves Federal cost-share funding.
	u	NEPA does not require that public comments on site-specific environmental assessments be included in the EIS. However, prior to project implementation, these documents are available for public review upon request and comments are considered prior to project implementation.
17	a	Comment noted.
	b	Eradication was dropped as a goal in the generally infested areas of the Northeast in the late 1950's. Since that time, however, eradication has been the goal in dealing with isolated populations of gypsy moth well removed from generally infested areas. It is the USDA view that eradication of these isolated populations is a realistic and cost effective goal. This is supported by a 1982 economic and operational analysis of the APHIS gypsy moth program (USDA 1982b).

Letter	Comments	Response
	c	Work published by Edwards and Fusco in 1981 (see page 28 of EIS), and Galt in 1983 (see page 11 of EIS), does in fact indicate that the gypsy moth "poses a credible threat to the west coast".
	d	See response 17b. USDA proposes to cooperatively fund eradication projects in the west in 1984.
	e	As pointed out in the FEIS, insecticide residues are degraded and diluted in the environment by a number of physical factors. This could account for some biological activity as long as 114 days. Carbaryl is considered to have a half-life of 10 days on foliage. We are not aware of information which indicates that much of the purported data on pesticide persistence may be erroneous. However, we have made an assessment of the human health risks from the use of all the proposed chemical insecticides.
	f	See Appendix F (RA/WCA).
	g	The USDA position on the use of B. t. for eradication purposes is stated in the FEIS. Also see response 10a.
	h	The USDA does not feel the definition of IPM should be changed to fit various situations. The discussion of IPM in the FEIS is consistent with the Departments position as stated on page 69 of the EIS.
18	a	Mitigating measures will be implemented to reduce insecticide exposure to sensitive individuals.
	b	The risk to sensitive individuals has been addressed in the FEIS. The USDA is aware of no law which states "spray drift is illegal". Mitigating measures are implemented in USDA cooperative projects to reduce drift to the lowest levels possible.

Letter	Comments	Response
	c	Comment noted. See response 10a.
	d	See response 17b.
	e	See response 17h.
	f	An effective IPM program includes the use of chemical insecticides in certain situations.
	g	*B. t.* and mass trapping can be effective in eradicating certain gypsy moth infestations.
19	a	These items are covered in the site-specific environmental assessments.
	b	See response 17b.
	c	The estimated timber losses are based on actual surveys and are statistically sound. See reference cited Stephens, G.R. and D. E. Hill, 1971.
	d	NEPA requires scoping sessions and public involvement and notification, but does not specify procedures for carrying out these activities. If the State of New York participates in a cooperative Federal suppression project, they would be required to inform the public of proposed actions.
	e	Comment noted. However, as indicated in the EIS, the no-action alternative eliminates Federal cost-sharing funding, thus no Federal involvement. USDA cannot set standards for State agencies under the no action alternative.
	f	Under the no-action alternative, the statement is true. We also concur with your statement that even with action vast numbers of acres will remain untreated as stated on page 14 of the EIS. Suppression can only be justified to protect a few high value areas from defoliation and tree mortality.

Letter	Comments	Response
	g	Funds allocated for suppression must be used for that purpose. We agree, there is some question as to whether Federal funds should be used for suppression on non-Federal lands. However, Congress continues to appropriate funds for this purpose.
20		The FEIS has been changed to better reflect what was intended.
21		No response required.
22		Comment noted.
23		The technologies available under the IPM alternative make it possible to put together a project without the need for untreated buffers. Since untreated buffers could jeopardize the goal of eradication projects, these areas can be treated with *B. t.* where necessary. Since the EPA never formally adopted the guidelines you cited, we have decided not to include them in the FEIS.
24	a	The concerns expressed in your enclosed Writ of Mandate with attached declarations were noted. These documents are not included in the final EIS, however, since we understand this case is currently in litigation.
	b	USDA's position on the efficacy of *B. t.* is discussed on pages 19, 20, and 69 of the FEIS.
	c	See response 10a. Relative to efficacy against gypsy moth see Appendix E (GM Eradication History). Control project data are only indirectly applicable to eradication situations. Also see discussion on page 69 of the FEIS.

Letter	Comments	Response
	d	See bottom of page 13 for discussion of eradication criteria. South Carolina has no general infestation. To our knowledge, the only reproducing population of gypsy moth in this State is in a recreational campground in Myrtle Beach. The difference between control or suppression and eradication is the expected goal of the project. Suppression projects take place in generally infested areas to reduce local impacts and eradication projects are carried out against isolated populations of gypsy moth geographically removed from generally infested areas. The decision relative to program goal is made at the State or local level. Effectiveness of control or suppression treatments are based on the degree of foliage protection achieved. Eradication projects are evaluated on the presence or absence of gypsy moth life stages inside treatment areas. A switch from eradication to control could occur when a gypsy moth infestation grows beyond the size that current technology and/or resources are reasonably available to pursue the eradication goal.
	e	See Appendix E (GM Eradication History).
	f	As projects are currently implemented, our experience indicates chemicals are more effective at high population levels; however, IPM has the potential for being as effective as chemicals alone. The success of the Santa Barbara project resulted from the application of carbaryl to key critical areas of the project. The USDA does have several alternatives for addressing the gypsy moth problem. These are discussed in the EIS.

Letter	Comments	Response
	g	Mass trapping alone has only been successful in Appletown, WS. Forty-three adults and several larvae were found in Monona, WS, in 1983. With only one success to date, there is not much efficacy data to detail. Efficacy of disparlure for eradication has not been demonstrated. The sterile release project in Michigan was judged a success while the test in North Carolina is in the final stages of evaluation. Insecticidal soap, in addition to reported use of carbaryl by several individuals, apparently eradicated a limited population in Vancouver, B.C. B. t. and mass trapping was also apparently responsible for eradicating a population in McHenry, Il. Other nonchemical pesticide alternatives are discussed on page 69 of the FEIS.
	h	NEPA requires that the public be given an opportunity to provide input into the decision-making process. How this is handled varies from State to State. In suppression projects, the local government makes the decision based on criteria developed at the State and/or Federal level. In eradication projects State regulatory agencies generally make the decision.
	i	Benefits favor eradication. See Galt 1983. Eradication projects are not considered to be short-term since all are conducted in conjunction with State and Federal regulatory programs aimed at reducing the incidence of long-distance artificial spread of the gypsy moth.
	j	This has been more thoroughly addressed in the FEIS, see Appendix F (RA/WCA).
25	a	We concur.
	b	We concur.

Letter	Comments	Response
	c	There is only one formulation of each of these materials registered for use against gypsy moth in suppression or eradication projects.
	d	This citation has been incorporated into the FEIS. However, under operational conditions we still do not consider that trichlorfon has been shown to have significant adverse effects on fish. See Appendix F (RA/WCA).
26	a	EPA reviewed the International Bio-Test (IBT) studies submitted for certain pesticide registrations. Dylox and dimilin were not listed by EPA as having studies done by IBT. For B. t., carbaryl, and orthene, EPA determined that the IBT issues had been substantially resolved. See EPA list, July 1983. Of 18 neurotoxicity effects tests done for carbaryl registration, the rat-cholinesterase study done by IBT was found to be supported by the raw data. Evaluation to see if the test meets current EPA standards is pending. Of the other 26 chronic tests on carbaryl, none were IBT studies. See EPA list, July 1983. USDA independently reviewed the information submitted in support of carbaryl and dylox registrations issued prior to the transfer of registration responsibilities, in 1970, to the newly created EPA. Since that time, action agencies within USDA monitor and review those new studies which are significant, germane, and relevant to their responsibilities (including compliance with NEPA).

Letter	Comments	Response
		Congress authorized EPA to regulate pesticide registrations, including some oversight of private laboratory quality control. USDA lacks authority and funding to audit conduct of private, independent testing laboratories or to duplicate EPA/FDA work done for FIFRA registration or Food Drug Cosmetic Act (FDCA) purposes.
	b	USDA does not rely on EPA registration for NEPA compliance; an independent analysis of human health risks is included in the FEIS. EPA considers registration valid whether conditional or unconditional. USDA uses pesticides only in accordance with FIFRA, including following label directions for registered products. Since registration of the insecticides listed in these documents is not at issue before EPA at this time, all users may continue using them.
		In 1978, through the RPAR process, EPA reviewed data on carbaryl which might raise questions of possible adverse health effects. In the RPAR process, USDA provides data and analyses to EPA. For example, USDA, jointly with the States and EPA, prepared a biological assessment report on carbaryl. Based on that and other information, in December 1980 EPA ruled that all carbaryl registrations should be continued. USDA also took part in a pre-RPAR review of data on dimilin after which the material was registered.
	c	EPA identified some data gaps in data supporting registration for carbaryl and B. t. and issued data call-ins. See EPA July 1983, list. EPA can be contacted for information about their specific data needs for FIFRA registration purposes.

Letter	Comments	Response
	d	USDA conducts or supports research such as exposure or residue studies, literature reviews, and risk assessments. Such research may be done on birth defects, oncogenicity, or gene mutations. See e.g., Norris, L.A., et al. 1983, General Technical Report PNW-149, Influence of Forest and Rangeland Management on Anadromous Fish Habitat in Western North America Forest Chemicals and Matsumura, F., and Ward, C. 1966, Degradation of insecticides by the human and the rat liver in Arch. Env. Health 13:257-261. Specific statutory provisions and fiscal constraints prevent USDA duplication of research done by other Federal agencies, such as NCI, NIH, FDA, or EPA.
	e	The issue of whether the USDA must do a RA/WCA on the uses ofcarbaryl had not been raised prior to recent litigation. However, after the judgment in the Kunzman case on January 26, 1984, the FS and APHIS prepared a RA/WCA for this program.
	f	This has been more thoroughly addressed in the FEIS, see Appendix F (RA/WCA).
	g	This has been more thoroughly addressed in the FEIS, see Appendix F (RA/WCA).
	h	The information on viral enhancement has been expanded in the FEIS.
	i	The statement you cite is a quotation from an EPA letter written by Mr. Douglas Campt, Director of the Registration Division to Mr. William Cranston, New Jersey Department of Agriculture. The sentence directly prior to the one you cite says, "One can never conclude that risk from exposure to any chemical is zero,...".

Letter	Comments	Response
	j	The discussion of human teratogenic potential has been expanded in the FEIS.
	k	The USDA fully understands chronic effects and the time necessary for them to manifest themselves. Because of the lack of data in this area, a worst case analyses is included in the FEIS.
	l	See response 24b.
	m	Recently the Ninth Circuit held that USDA may not rely solely on EPA registration for purposes of NEPA. See SOS/Merrel case. Therefore, the status of EPA's laboratory audits under FIFRA, its registration procedures, and critiques of the EPA registration system are irrelevant to and outside the scope of this EIS. Public comments concerning the FIFRA registration process may be directed to EPA.
	n	The final decision document on carbaryl issued by the EPA speaks for the agency. For this reason, we will not comment on or include in the EIS documents relating to it not officially issued by that agency. Also, see response 26m.
	o	We concur.
27	a	This has been more thoroughly addressed in the FEIS, see Appendix F (RA/WCA).
	b	"Abnormally sensitive". The risk to chemically sensitive individuals is more thoroughly discussed in the FEIS.
	c	Comment noted. See response 27a.

Letter	Comments	Response
	d	USDA experience with the use of carbaryl does not support the necessity for leaving treatment blocks for this period of time. However, persons known to be sensitive to insecticides should make every effort to contact responsible local officials as to their condition, and to carefully follow all medical advice received.
	e	In order for eradication treatments to be effective, all infested areas must be treated. In some cases this can be achieved with nonchemical alternatives.
	f	This has been more thoroughly addressed in the FEIS, see Appendix F (RA/WCA).
	g	See response 26a.
28		The Pesticides Investigations Unit will be consulted.
29	a	The DEIS makes no reference to IPM as "a two part theory". We see nothing in the discussion of IPM that conflicts with the statement quoted from the IPM Practitioner.
	b	Sources used in developing this estimate were: Campbell and Valentine 1972. Gansner, D.A., and Owen W. Herrick, Forest Stand Losses to Gypsy Moth in the Poconos. Forest Service, Northeastern Forest Experiment Station, Broomall, PA 1978. McCay, Roger E., and William B. White, Economic Analysis of Gypsy Moth Problem in the Northeast: I. Applied to Commercial Forest Stands, USDA Forest Service Research Paper NE-275, 1973.

Letter	Comments	Response
		Moeller, George H., et al., Economic Analysis of the Gypsy Moth Problem in the Northeast. Part III. Impacts on Home Owners and Managers of Recreation Areas, USDA Forest Service Research Paper NE-360, 1977.
		Wargo, Philip M., Defoliation by the Gypsy Moth: How It Hurts Your Tree, USDA Home and Garden Bulletin No. 223, 1978, p. 2.
	c	Isolated infestations of gypsy moth have been eradicated. See Appendix E.
	d	All comments received on the DEIS are included in FEIS.
	e	See response 29c. The major objectives of gypsy moth suppression projects are larval population reduction and foliage protection. These objectives are defined in each State suppression proposal. With minor exceptions, these objectives have been met with chemical insecticides on all State projects. Project accomplishment reports are available from cooperating State agencies upon request.
	f	The USDA is not only aware of New Jersey's parasite and predator program, but has contributed significant funds to it in the past. However, parasites and predators appear to be effective only when gypsy moth populations are at low levels.
	g	The USDA regulatory program directed towards reducing the artificially, long-distance spread of gypsy moth has been highly successful. Natural spread; however, continues at the rate of from 5-15 miles a year.
	h	Based on considerable experience and past history, it is the USDA's reasoned judgment that there will be no irreversible or irretrievable adverse environmental impact.

Letter	Comments	Response
	i	Some *B. t.* caused mortality may occur within a 3- to 7-day period. However, depending on the application rate for aerially applied *B. t.*, a more realistic estimate is that it will take 7 to 10 days for significant mortality to occur.
	j	Spray swath overlap is a normal occurrence in aerial application projects. This subject is addressed to some extent in Appendix F (RA/WCA). In reviewing the available information on the insecticides used in gypsy moth suppression, we could find no significant data supporting synergistic effects. Symptoms of pesticide poisoning for all of the insecticides utilized in gypsy moth suppression and eradication are available on pesticide labels and technical data sheets. Reports on such incidents are investigated by State pesticide agencies when they occur. This subject is discussed in Appendix F (RA/WCA). Except for trichlorfon, the active ingredients of all the insecticides used for gypsy moth suppression or eradication are available to the homeowner in some type of formulation. Harvesting schedules are provided as label restrictions for all of the insecticides used. True, all of the insecticides used are mixed with carriers, but not all of the insecticides have stickers added to the spray mix. Except for trichlorfon, most State cooperators now utilize formulations that use water as a carrier.

Letter	Comments	Response
	k	All of the major issues and concerns are addressed in the FEIS. In the development of this FEIS, the issues have been handled as follows: Issue 1, 4, 5, 7, 8, and 9, are discussed. Issue 2, Public education - This is certainly an important aspect of the gypsy moth problem, but it is not entirely within the scope of the FEIS process. Issue 3, Public involvement and notification - This issue is discussed in this FEIS. However, more indepth discussion is included in the site-specific environmental assessments. Issue 6, Availability of past and current environmental impact statements - A new statement covering the availability of EIS's has been added to the FEIS.
	l	The USDA does not conduct suppression or eradication projects unless the projected benefits warrant such action.
	m	The agency goal statement also states that "The USDA gives special emphasis to the development and use of efficient and environmentally acceptable integrated pest management systems. If project objectives under all situations can be met economically, environmentally and in an efficacious manner with the least harmful insecticide, it will be utilized.
	n	See response 29c.
	o	See discussions of agency goals on page 13 of the FEIS.
	p	See response 27f.
	q	See responses 29 c and g.

Letter	Comments	Response
	r	From major issues and concerns identified through the public scoping process, individuals indicated that potential allergic reactions from contact with larval hairs, excrement, and moth wing scales were public concerns, which can be reduced as a result of treatment. We are not aware of any studies related to reactions from excrement.
	s	This is based on observations documented by a number of State agencies in the Northeast.
	t	The USDA feels "some" is sufficiently accurate for the purposes of the FEIS.
	u	We know of tests only on limited species of insects.
	v	Prevention of tree mortality is one goal of suppression projects. We have only limited success with the use of *B. t.* for eradication.
	w	The public notification process as detailed in site-specific environmental analyses should mitigate potential problems in this area.
	x	This is done by various States when it is deemed necessary.
	y	This comment is outside the scope of NEPA.
	z	The USDA disagrees with this comment. We stand by the statements made on page 24 of the DEIS.
	aa	Weather balloons or other appropriate markers are used when deemed necessary by project personnel.
	bb	This is the reason for the statement (2) on page 25 of the DEIS.

Letter	Comments	Response
	cc	Observer aircraft are used when deemed necessary by project personnel.
	dd	No.
	ee	This is a case study of one area in New Jersey and may represent an extreme case. The results of the study are included to show the extremes of the problem. Since most of the dominant susceptible hosts were killed on the area, the susceptibility of the area to further heavy defoliation and mortality has been reduced. Eventually, as the susceptible seedlings and saplings mature, the area will again become susceptible to heavy larval defoliation.
	ff	We do not agree that the points on gypsy moth impact are taken out of context. There are examples which are even more dramatic than the ones cited.
	gg	No.
	hh	No direct comparison of frass on water quality with pesticide run-off is intended. This discussion deals strictly with a No Action alternative.
	ii	This is sufficient reason for individuals who feel this way.
	jj	Pesticide poisoning symptoms are not considered in a No Action alternative. See Appendix F (RA/WCA) for further discussion on pesticide poisoning symptoms.
	kk	In areas where gypsy moth populations are high, it is not a rare event to find caterpillars "invading" homes.
	ll	These issues are addressed in the FEIS.

Letter	Comments	Response
	mm	The USDA does not make a claim or infer "that drift did not occur." Data from the 1978 Maine Carbaryl Study "indicated that drift did not occur."
	nn	See comment by Dr. Sandifer based on 1979 South Carolina studies cited on page 52 of EIS.
	oo	We are aware of the Ticehurst, et al. (1982) reference and others that discuss the positive effects to biologicals by using sublethal doses of pesticides. Although this appears promising, we are not aware of any studies demonstrating the overall success of this approach.
	pp	USDA funds are being used to develop biological approaches to the solution of the gypsy moth problem and in educating the public about it.
30		These concerns will be taken into consideration in any implementation of the proposed program.
31	a	Most of these areas are covered in locally prepared site-specific environmental analysis. Additional clarification of agency roles was added to the discussion of this subject in the FEIS.
	b	See response 31a.
	c	The management situation varies to the extent that a simple matrix would not enhance the evaluation of alternatives and project impacts except on a very superficial level. Relative to public notification, it is the USDA's position that all individuals who may have reason to be in proposed treatment areas (suppressive and eradication) should be aware of such treatments. Local guidelines and site-specific environmental assessments provide for public notification for each treatment area.

Letter	Comments	Response
	d	We concur.
	e	This change was made in the FEIS.
	f	Worst case analyses have been included in the FEIS.
	g	Comment noted.
	h	Comment noted.
	i	See response 3b.
	j	Citation corrected.
	k	The FEIS contains no bibliography only references cited are included in the FEIS.
	l	Chemical names are provided.
	m	Correction made.
	n	Correction made.
	o	In the interest of lay understanding, we have retained the original term.
	p	Reference has been added to the FEIS.
	q	A brief reference to the use of carbaryl for the control of oyster pests is included in the FEIS.
	r	Standard tests are referred to.
	s	Chitin is a common constituent in the cell walls of higher fungi and is especially present in high concentrations in the cell walls of commercial mushrooms. Chitin formation in fungi is the result of a different synthesis process than what occurs in insects. Because the process is different, dimilin has no effect on chitin in the cell walls of mushrooms. Diflubenzuron is currently registered and food tolerances have been established for the application of the insecticide to commercial mushrooms for the control of insect pests.

Letter	Comments	Response
	t	None that we know of currently.
	u	Comment noted and change made in text.
	v	Comment noted and change made.
	w	We have no reason to expect that eradication projects will have effects on water bodies that would differ from suppression projects. Water quality is a primary consideration in the conduct of all cooperative suppression or eradication projects. Details on this, where appropriate, are covered in site-specific environmental analyses.
	x	Models have been developed for predicting gypsy moth population fluctuations. Since these models have proven to be rather unreliable, they are not used in the selection of treatment alternatives.
	y	The half-life of the biological treatment is not the critical factor here, it is the limited period of time during which the gypsy moth larva is most susceptible to B. t.
32	a	Safety aspects are covered in site-specific environmental analysis documents. In addition, State agencies must provide a project work and safety plan to the USDA, that provides additional information on this subject. All significant pesticide spills or incidents must be reported to USDA immediately and a detailed report submitted within 48 hours explaining what mitigating action and clean-up action was taken. Most State agencies must also make similar reports to State Pesticide Agencies. Pesticide applicators must be certified under State Law and FIFRA. In addition, some States require regular monitoring of certified applicators that are occupationally exposed to insecticides.

Letter	Comments	Response
33	a	This is included in the FEIS.
	b	An expanded research effort on B. t. is underway.
34	a	Comment noted. See changes on page 13 and 14 of FEIS.
	b	We see no conflict between your definition of IPM and what is stated. Monitoring and determination of action levels are thoroughly discussed in site-specific environmental analyses. Since much of the gypsy moth IPM technology is still in the developmental process, there is no pre-determined "strategy or mix of tactics" that is most appropriate. This is handled on a State-by-State and in many cases site-by-site basis. Also, see response 10c.
	c	a. See response 26c.
		b. See response 26k.
		c. Although listing the toxicity of metabolites would be possible, it is not necessary because the toxic responses noted on page 39 actually include the response caused by the parent compound (acephate), any metabolites, or any derivatives formed. When acephate is applied, either in a laboratory study or operationally, the biological response comes from both the activity of acephate and its metabolities as long as the metabolite exists long enough to cause a response.
		d. The two studies referred to on page 63 do not mention acephate, so we cannot respond further.

Letter	Comments		Response
		e.	Your statement, "EPA registration of pesticides is not based on a determination of safety and neither does EPA withhold registration for lack of data.", is incorrect. EPA pesticide registration is based on a lack of unreasonable risk to human health and the environment and they do withhold registration for lack of data when necessary. There is ample evidence that gypsy moth will do well in the Pacific Northwest in Tacoma where a healthy reproducing population was found in 1983. Also, see page 38 for discussion of methamidophos.
	d		Suggested change included in the FEIS.
	e		We do not state that "the biological insecticide alternative is only justified".... Also, see response 10a.
35	a		No response required.
	b		See response 17b and Appendix E (GM Eradication History).
	c		Portions of Stokes State Forest were heavily defoliated during 1978, 1979, and 1980. No information is provided in the report to indicate that the trees were under any type of stress that would pre-dispose them to mortality. We are not aware that any control action was taken on this Forest between 1975 and 1978.

Letter	Comments	Response
	d	We agree that there are some risks associated with the use of chemical insecticides, but believe these are acceptable for the programs as proposed. Cultural and biological methods of control will be used whenever feasible.
	e	Comment noted. See response 34b.
	f	Removal of egg masses and encouragement of parasites and predators are known to have little effect on high level gypsy moth populations.
36	a	We do not consider minor health complaints that have not been substantiated by the medical community to be significant. Pesticide poisonings are routinely reported and investigated by State Pesticide Regulatory agencies.
	b	We concur.
	c	Project objectives vary. In some areas, higher levels of defoliation are acceptable; however, defoliation in excess of 60 percent can be expected to have negative impacts on tree condition. If precise rates of pesticides (chemical or biological) gave precise degrees of foliage protection, it would be a rather simple matter. Unfortunately, this is not the case.
	d	See response 29i.
	e	Table 1 shows the acres of detectable gypsy moth-caused defoliation based on aerial surveys. Most State surveys do not include light (less than 30 percent) defoliation due to difficulties in differentiating it from other abnormal foliage conditions. The table is presented as a historical account of the annual amount of defoliation in each State.

Letter	Comments	Response
		It is unfortunate that municipalities go against the advice of State agency personnel and contract for unnecessary treatment at their own expense. However, we doubt that any decisions have been based on the defoliation data in Table 1. In some cases, municipalities have contracted for ground application of chemical insecticides after the community was treated with a biological insecticide because residents were unsatisfied with the slower insect mortality from the biological material.
	f	In forested areas that have never been treated with biological or chemical insecticides, that have ample established parasite and predator populations, the gypsy moth continues to cause heavy defoliation in cyclic occurrences. If these biological organisms were effective, the amount and extent of heavy defoliation would not be as great. The fact remains that parasite and predator populations seldom account for more than 20 to 30 percent population reduction in a given area, and would never be effective in meeting eradication objectives, and are most effective when gypsy moth populations are at low levels.

Letter	Comments	Response
	g	Based on efficacy data for chemical insecticides, a minimum of 90 percent population reduction and 70 percent foliage protection should be attained. A 90 percent reduction in larval mortality is not needed to prevent tree mortality; this reduction will, in all but extreme cases, prevent the need for re-treatment the following year. In high value trees, aesthetics are a secondary objective that occurs as a result of preventing tree mortality and excessive defoliation.
	h	See response 29i.
	i	We concur. The word "probably" has been deleted from the FEIS.
	j	The specific methods of notification are left up to the States. It would be by letter or personal contact. The location of specific spray blocks are well publicized, so landowners of adjacent property will be aware the adjoining property has been proposed for treatment. At local public meetings, the type of pesticide proposed for use and precautionary measures will be discussed.

Letter	Comments	Response
	k	In some cases, local residents decide whether to participate or not. If town councils make this decision, they are the elected representatives of the local residents.
	l	The USDA is unable to identify any Executive Order restricting use of pesticides on Federal lands to biological materials.
	m	Comment noted. The Federal Aviation Agency has authority in this area.
	n	See response 29cc.
	o	Part 137.53 of the FAA regulations covers the operation of aircraft over congested areas. Waivers have been obtained to operate single engine application aircraft over such areas. The FAA should be contacted relative to criteria for obtaining such waivers.
	p	See response 29cc. The pilot is relied upon for accurate deposition of spray materials in the target area regardless of the guidance employed. Misapplication of pesticides falls under the enforcement authority of the EPA.
	q	Project personnel responsible for the aerial application would make this determination. Such determinations are based on input from a number of sources, including ground observers and application pilots.

Letter	Comments	Response
	r	Projects in areas where school children would be present poses a special problem that is considered in scheduling applications. One mitigation measure employed is to stop applications during this period of time.
	s	Generally, ground application is not used in suppression projects, but is used in some eradication projects where acreages are too small for efficient aerial application or where adequate coverage can be obtained with ground equipment.
	t	The public notification process is intended to provide adequate information to the public, including bee-keepers. Where bees are of sufficient concern, alternatives are available to mitigate any potential bee problems. A special effort is made to identify any potential bee problems. Unusual situations or complaints can be directed to project leaders who have authority to take whatever action is necessary.
	u	In most suppression projects, post-hatch monitoring is done to determine if treatment is warranted.
	v	The major purpose of defoliation surveys is to assess the amount of defoliation. Healthy deciduous trees experiencing over 60 percent defoliation will usually refoliate.
	w	Egg mass surveys are conducted in the representative sample blocks which were used to assess larval mortality.

Letter	Comments	Response
	x	The areas you refer to would normally only be treated in isolated infestations where eradication projects are being conducted.
	y	Treatments on private properties are conducted under the authority of State Plant Regulatory agencies. Some States may choose to handle individual situations under tightly controlled compliance agreements although this is not generally done.
	z	Comment noted. See response 29ee.
	aa	Increased stream flow in reduced water quality resulting from tree defoliation and mortality is well documented in the literature.
	bb	Yes, it has been positively established with laboratory-reared insects which have not been exposed to chemicals. It is possible that individuals who are extremely sensitive to pesticides could have rashes from chemical residues on caterpillars.
	cc	Comment noted. See Appendix F (RA/WCA). Sevin 4 oil® is registered for use on food crops, e.g., corn. Many formulations of carbaryl are registered for use on food crops. We suggest following the harvest schedule established for the specific food crop which may be of interest to you.
	dd	Providing Federal and State entomological technical assistance to communities and individuals will help prevent unnecessary treatment.

Letter	Comments	Response
	ee	See response 27b.
	ff	In spite of the toxicity of 1-naphthol to mollusks and fish, carbaryl is registered for use in "marine and estuarine environments to control crustaceans which compete with oyster farming." See comment 31q.
	gg	This statement has been changed in the FEIS to read "the registered use of carbaryl has no direct adverse effects...."
	hh	Because of this type of scientific uncertainty, worst case analyses are included in the FEIS.
	ii	EPA has restricted the label as indicated until the results are available from long-term feeding studies. Current label restrictions are followed.
	jj	See response 29oo.
	kk	Since parasite/predator technology is not a current operational component of IPM, introduction, rearing, and release costs were not included. See also response 29f.
37		This will be done in the site-specific environmental assessments.
38	a	The text of the FEIS has been changed to reflect this concern.

JAN 2 0 1984

1

TO: R. Max Peterson, Chief
U. S. D. A. Forest Service
Post Office Box 2417
Washington, D. C. 20013

FROM: Office of Planning and Budget
Management Review Division
State Clearinghouse
270 Washington Street, S.W.
Atlanta, Georgia 30334

DATE: January 12, 1984

SUBJECT: RECEIPT OF NOTIFICATION OF INTENT TO APPLY FOR FEDERAL ASSISTANCE/PREAPPLICATION/APPLICATION/PROPOSED PERMIT/DIRECT FEDERAL DEVELOPMENT/ENVIRONMENTAL INFORMATION

APPLICANT: Department of Agriculture

PROJECT: DEIS - Gypsy Moth Suppression

FEDERAL IDENTIFICATION NUMBER (If applicable):

STATE APPLICATION IDENTIFIER: GA 84-01-12-003

REVIEW COMMENTS DUE BY: February 12, 1984

OFFICE OF PLANNING AND BUDGET CONTACT: C. Badger/S. Williams

Correspondence related to the above project was received by the State Clearinghouse on January 12, 1984.

The review has been initiated and every effort is being made to ensure prompt action. The proposal will be carefully reviewed relative to its consistency with goals, policies, plans, objectives, programs, and if applicable, with budgetary restraints. You may expect to be informed by the State Clearinghouse of the results of the initial review by February 14, 1984. If you have not been contacted by the State Clearinghouse by this date, your proposal may be considered consistent. Your completed application should include this letter as evidence of compliance with Executive Order 12372.

In future correspondence regarding this project, please include the State Application Identifier Number shown above. If you have any questions regarding this project, please call us at (404)656-3829 or 656-3855.

Form SC-1
July 1983

2

MARYLAND

DEPARTMENT OF STATE PLANNING

301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

HARRY HUGHES
GOVERNOR

CONSTANCE LIEDER
SECRETARY

January 17, 1984

Mr. Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Reply Due: 2/10/84

State Identification Number: 84-1-262

State Clearinghouse Contact: Samuel Baker

RE: U.S. Department of Agriculture
DEIS - Gypsy Moth Suppression & Eradication Projects

Dear Mr. Schenarts:

This is to acknowledge receipt of the referenced subject. We have initiated the Maryland intergovernmental review and coordination process as of this date. You can expect to receive review comments and recommendations on or before the reply date indicated. If you have any questions concerning this review, please contact the staff member noted above.

The State Identification Number must be placed on any financial assistance application form and used in future correspondence.

We are interested in the referenced subject and will make every effort to ensure a prompt review. Thank you for your cooperation.

Sincerely,

G. B. Gatch

for Guy W. Hager
Director, Maryland State Clearinghouse
for Intergovernmental Assistance

GWH/

TELEPHONE: 301-383-7875
OFFICE OF STATE CLEARINGHOUSE

JAN 23 1984

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Office of Apiculture
Department of Entomology
Ithaca, N.Y. 14853
Telephone: 607-256-5443

3

January 17, 1984

Mr. Thomas N. Schenarts
Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schenarts:

I have the Draft Environmental Impact Statement for Gypsy Moth Suppression and Eradication Projects. It is a sloppy piece of work.

On Page 42, at the end of the second paragraph, I am referred to and the document reads, "covering hives before treatment can also reduce losses." The reference that is given is one that I wrote in 1972 (incidentally, the reference is not properly cited in the References Cited Section and it also contains a spelling error). In the paper written in 1972 I make it very clear that while some people recommend covering hives, I do not and I consider it a dangerous practice. The way in which I am referred to in the Impact Statement is about as unkind and malicious a way of referring to an individual that I have seen in some time! a

1/23

On Page 17 there is mention, in the next to the last paragraph, of various formulations of Sevin (carbaryl) that might be used in treating for Gypsy moth. It is correct that the Union Carbide Corporation has stated that Sevin XLR is relatively non-toxic to honey bees. In presenting data to the Environmental Protection Agency to obtain the label they now have, they failed to present any data from the Northeastern United States. We have data on XLR from only one test made in 1983 and under our conditions the XLR was fairly toxic to honey bees. Attached is a copy of notes taken from one of our field books. We plan more tests in 1984. b

In general I find the discussion as it regards honey bees and other pollinating insects to be shallow.

Sincerely,

Roger A. Morse
Professor of Apiculture

RAM:lgh
Enc.
cc: Robert L. Williamson, USDA-APHIS

The Effect of Sevin XLR on Honey Bees in New York State

On June 11, 1983, at 6:00 a.m., the village of Odessa, Schuyler Co., New York, was sprayed with the insecticide Sevin XLR® (Union Carbide) at the rate of 1 lb. active ingredient per acre as a measure against the Gypsy moth. The sprayed area covered some 350 acres and was mostly wooded gardens, houses and roads.

Ten days prior to the spraying eight colonies of honey bees were moved into the area. These were located in pairs, with two pair in the sprayed area and two pair ca. 1/3 mile outside. The colonies used were equalized so that each pair had approximately equal numbers of brood and foragers. Each colony was fitted with a dead bee trap and numbers of dead bees were counted each morning. The table below shows the results.

Mean numbers of dead bees recovered per colony in dead bee traps

	Dates in June 1983								Total Killed June
	10	11	12*	13	14	15	16	17	12-17
Colonies within sprayed area	43	70	2591	1774	772	535	394	202	6268
Colonies outside sprayed area	96	77	89	96	150	123	124	58	640

*Spray Date

January 17, 1984

The above notes were taken from a field book and represent preliminary data only. The samples taken have not yet been analyzed.

Roger A. Morse
Department of Entomology
Comstock Hall
Cornell University
Ithaca, NY 14853

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

received
1/25

4

FEB 3 1984

EC

JAN 20 1984

In Reply Refer To:
ER-84/87

Mr. R. Max Peterson
Chief, USDA Forest Service
P.O. Box 2417
Washington, D.C. 20013

Dear Mr. Peterson:

This is in regard to our receipt today of the draft environmental statement concerning the Gypsy Moth Suppression and Eradication Projects put out jointly by the Forest Service and the Animal and Plant Health Inspection Service.

This is to inform you that the Department will have comments but will be unable to reply within the allotted time. Please consider this letter as a request for an extension of time in which to comment on the statement.

Our comments should be available about March 5, 1984.

Sincerely yours,

Bruce Blanchard, Director
Environmental Project Review

cc: Bert Hawkins
Administrator, APHIS

FOREST SERVICE
RECEIVED

JAN 26 1984

FOREST PEST
MANAGEMENT

THE PROCTER & GAMBLE PAPER PRODUCTS COMPANY

5

P. O. BOX 32 MEHOOPANY, PENNSYLVANIA 18629

JAN 25 1984

January 23, 1984

~~Director~~
~~Programs~~
~~Methods~~
~~Coordination~~
~~Pesticides~~
R-9 Pest Coord.
Clerical
MFO
SPFO
DFO
File

Mr. Thomas N. Schenarts
U. S. Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schenarts:

I have evaluated the DEIS describing projects involving the suppression and eradication of the Gypsy Moth. Of the option/alternatives discussed, we are strongly in support of the IPM direction. The other alternatives have been used extensively and have proven to be costly failures.

The only added comment to the DEIS I could offer would be:

"Fuse state and federal efforts into a regional thrust to protect against duplication and to assure a coordinated and meaningful direction." a

If we can be of further assistance, please advise.

Sincerely,

Nelson E. Folsom

Nelson E. Folsom
Wood Procurement Manager

NEF:ms

RECEIVED
DIRECTOR, NA-S & PE COOP.
JAN 25 RECD
a. m. p. m.

FEB 6 1984

6

OREGON PROJECT NOTICE ACKNOWLEDGEMENT

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N.E.
Salem, Oregon 97310

Phone (503) 378-3732 or Toll Free in Oregon 1-800-422-3600

APPLICANT: USDA Forest Service

PROJECT TITLE: Gypsy Moth Suppression & Eradication Projects

DATE RECEIVED: January 31, 1984

PNRS # OR 840131-072-4

Your project notice has been assigned the file title and number that appear above. Please use it in correspondence and, if applicable, enter it in Block 3A on the 424 form for the project. Your project notice must also be submitted for review to any affected areawide clearinghouse.

A 45 day review of your project began on the above date.

[ ] FEDERAL GRANT

[ ] HUD HOUSING

[ ] DIRECT FEDERAL DEVELOPMENT

[ ] ENVIRONMENTAL ASSESSMENT

[X] DRAFT ENVIRONMENTAL IMPACT STATEMENT

[ ] FINAL EIS

[ ] STATE PLAN/AMENDMENT

Your project notice was circulated to state agencies checked below:

ECONOMIC DEV. & CONSUMER SVCS
- X Agriculture
- X Soil and Water
- __ Economic Development
- __ Fire Marshal
- __ Housing
- __ Labor
- __ Real Estate

EDUCATION
- __ Education
- __ Educ. Coordinating
- __ Higher Education

EXECUTIVE
- __ Budget

HUMAN RESOURCES
- __ Adult and Family Services
- __ Children's Services
- __ Community Services
- __ Corrections
- __ Employment
- __ Health
- __ Mental Health
- __ Senior Services
- __ Vocational Rehabilitation

NATURAL RESOURCES
- X Governor's Office
- X DEQ
- X Energy
- X Fish and Wildlife
- X Forestry
- X Geology
- X Lands
- X LCDC
- X Water Resources

TRANSPORTATION
- __ Aeronautics
- __ Director
- __ Highway Division
- X Historic Preservation
- __ Parks Division
- __ Public Transit

MISCELLANEOUS
- __ Dev. Disabilities Council
- __ Extension Service
- __ Other

State Clearinghouse use only:
St. Agency Due Date: ____________
Federal Agency: ____________
County: ____________

PNRS #6
Revised 10/83

FEB 6 1984

7

HAMMERMILL PAPER COMPANY

1540 East Lake Road
Erie, Pennsylvania 16533
814 456-8811

January 31, 1984

Mr. Thomas Schenarts
Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schenarts:

From a layman's standpoint, after several years of reviewing Gypsy Moth plans, it was a pleasure to pick up your current Suppression and Eradication Project Draft EIS and find it easy to read as well as meaningful. This particular document appears to deal with the overall problem rather than individual state assessments, hence there is less redundancy. For once, the full realm of effects both good and bad of the various treatment opportunities and the use of both biological and chemical treatments appears to be dealt with in good taste and with scientific reasoning. In addition, the importance of timber resources and the potential damaging effects of Gypsy Moth on them seems to have been a given greater role. Hammermill as a prime user of such wood products feels this is long overdue. a

If the document falls short of its predecessors, it's in the lack of a preferred alternative or individual 1984 treatment plans for the various federal and state agencies. Possibly this is to be covered in a separate report or in the final EIS statement. b

It's not made entirely clear what options are available to the large private forest landowner. Hammermill has in the past and will continue in the future to support and contribute towards various state and federal suppression and research efforts. If there are additional opportunities for a company such as ours to consider, it would be nice if these could be spelled out. c

Since this document could serve as an excellent volume for our people, is it possible to obtain several more copies? If so, please send them to the above address. d

Again, we appreciate the opportunity to be part of this review process. If there are any questions or if further input is needed, feel free to contact us.

Sincerely yours,

HAMMERMILL PAPER COMPANY

Robert J LaBar

R. J. LaBar
Forest Resources Administrator

nk

cc: Mr. A. M. Aimonetti
Mr. B. C. Bond - Selma
Mr. J. H. Speice
Mr. R. G. Wallace

DAVID E. BOSWELL
COMMISSIONER

OFFICE TELEPHONE
502-564-4696

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF AGRICULTURE
CAPITAL PLAZA TOWER
FRANKFORT, KENTUCKY 40601

February 2, 1984

Ms. Valerie A. Wickstrom
Office of the Secretary
Natural Resources & Environmental
Protection Cabinet
Capital Plaza Tower, 5th Floor
Frankfort, KY 40601

Dear Ms. Wickstrom:

I share the concerns of many Kentuckians regarding the spread of the gypsy moth. Although Kentucky-based timber interests should be protected from this destructive pest, it must not be at the expense of the environment. Bees, wildlife, aquatic organisms, humans, and other non-target inhabitants of the affected areas should be foremost in the planning process.

For this reason, we strongly suggest that all possible efforts be made to explore integrated pest management and biological controls before resorting to chemical spray programs. If non-chemical alternatives prove to be impractical, insecticides should be chosen wisely and used in strict accord with label directions.

I hope these comments will be helpful in your efforts. If you desire additional input, please let me know.

Sincerely,

David E. Boswell

David E. Boswell
Commissioner

EC /

received 9
2/10

Route to FPM

Alabama Department Of Economic And Community Affairs

GEORGE C. WALLACE
GOVERNOR

W.M. "BILL" RUSHTON
DIRECTOR

FOREST SERVICE
RECEIVED

FEB 13 1984

FOREST PEST
MANAGEMENT

February 6, 1984

TO: Mr. R. Max Peterson, Chief
USDA Forest Service
P. O. Box 2417
Washington, DC 20013

FROM: Donna J. Snowden, Single Point of Contact
Alabama State Clearinghouse
OSPFP Division, ADECA

DJS

SUBJECT: PLANS, STUDIES, AND OTHER DOCUMENTS--RECEIPT

Applicant: USDA Forest Service

Project: Draft Environmental Impact Statement: Gypsy Moth Suppression and Eradication Projects for Alabama and other States

State Application Identifier Number: OSP-004-84

The above document has been received by the State Clearinghouse. Please note that this document has been assigned the SAI Number shown above. In future correspondence on this document, please refer to the SAI Number. Your cooperation is appreciated.

This document has been distributed to appropriate agencies, and every effort is being made to ensure prompt action. You will be advised of any comments received.

If you need assistance, please feel free to contact me at (205) 284-8905. If I am not available, please talk with Moncell Thornell at (205) 284-8904.

OSP/04

BRICKLIN & GENDLER
ATTORNEYS-AT-LAW
SUITE 900 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101

DAVID A. BRICKLIN
MICHAEL W. GENDLER

(206) 621-8868

FEB 1 1984

February 7, 1984

Thomas N. Schenarts
Area Director
U.S.D.A. Forest Service
370 Reed Road
Broomall, Pennsylvania 19008

Re: Draft EIS: U.S.D.A. Gypsy Moth Suppression and Eradication Projects

Dear Mr. Schenarts:

I write on behalf of Seattle Citizens for the Safe Control of Gypsy Moth, a neighborhood, public interest group that has been monitoring the gypsy moth suppression/eradication program in Seattle, Washington. We take this opportunity to comment on the above-referenced DEIS.

As you are aware, we have had phenomenal success with the use of the biological insecticide, B.T., here in Washington. For instance, in Seattle (Ravenna Park), three aerial applications of B.T. at 16 BIU resulted in a decrease of males trapped from 400 in 1982 to just 32 in 1983. Similar results were obtained in other areas in this state as well as in Wisconsin and Illinois. (See attached chart).

The efficacy of this B.T. program has been underscored by the results of recent intensive egg mass searches in the Ravenna area this winter. With the search 90% complete, only three egg masses have been found, and even their viability was in question.

As a result of B.T.'s impressive record during the 1983 spray season, and the substantially less adverse environmental impacts associated with B.T., we believe B.T. should have been designated as the preferred alternative by U.S.D.A. a

Additionally, there appears to be no discussion of using B.T. in a spot ground application program as an adjunct to a broader scale aerial application. We are advocating the development of such a program here this year. B.T. would be applied from b

the ground on individual properties which are known to be hot spots as a result of results from the prior years trapping and the prior winter's egg mass search.

We are confused and concerned with the statement on page 21 that IPM will perform less effectively than the chemical insecticide alternative and somewhat better than the biological insecticide alternative. Because IPM can potentially incorporate both the chemical and biological insecticide alternatives along with other control strategies, it seems that IPM would necessarily be more effective if implemented properly. Indeed, we believe that an IPM strategy which excludes the use of chemical insecticides can be equally efficacious and less environmentally destructive than any other alternative -- at least where you are dealing with isolated spot infestations. We proved it last year here in Seattle. C

We thank you for this opportunity to comment.

Very truly yours,

BRICKLIN & GENDLER

David A. Bricklin

David A. Bricklin

DAB/b

Encl.

cc: Ravenna-Bryant Community Association
Friends of the Earth
Western Washington Toxics Coalition

1983 Eradication Treatments

Bacillus thuringiensis

	Males trapped 1982	Acreage treated	Acreage mass trap	Number of applications	Rate of application (BIU)	Post treatment males
Washington						
Ravenna Park 1/	400	1,040	1,040	3	16	32
Tacoma-East	117	800	-----	3	16	5
Tacoma-West 2/	253	320	-----	3	16	33
Vancouver	10	360	-----	3	16	0
Wisconsin						
Elm Grove	70	60	110	2	17.5	3
Illinois						
Napierville	17	40	200	2	17.5	0
Downers Grove	21	50	367	2	17.5	1
Wheaton 3/	103	230	800	2	17.5	5
Wood Dale-Bensonville 4/	166	989	1,532	2	17.5	9
St. Charles	26	90	-----	3	17.5	1

1/ Ravenna Park — Two possible foci of reproduction still present near the core of treatment block; site where 1981 treatments applied (17th Avenue) and where egg masses were found in 1982 (12th Avenue). Also, possible activity in the vicinity of 25th Avenue and 70th Street.

2/ Tacoma-West — All moths caught in the edge of the treatment block. Highly likely all came from separate area of infestation to the west.

3/ Wheaton — All five moths caught outside *B. t.* treatment block.

4/ Wood Dale/Bensonville — Mass trapping conducted by municipalities not completed as planned. All catches were singles, two of which were trapped outside the *B. t.* treatment block.

Charlotte E. Baldwin
Secretary

FEB 1 1984

Martha Layne Collins
Governor

Commonwealth of Kentucky
Natural Resources and Environmental Protection Cabinet
Office of the Secretary
Frankfort, Kentucky 40601
Telephone (502) 564-3350

February 7, 1984

Mr. Thomas N. Schenarts
Area Director
USDA Forest Service
370 Reed Road
Broomall, Pennsylvania 19008

RE: Draft EIS - Gypsy Moth Suppression and Eradication Projects

Dear Mr. Schenarts:

The Kentucky Natural Resources and Environmental Protection Cabinet (NREPC) serves as the State Clearinghouse for review of environmental documents for Kentucky State Government. Comments from the Kentucky Department of Agriculture on the above referenced document are attached. A copy was also sent to the Kentucky Division of Forestry for review by your office. However, the Division of Forestry did not have any comments to provide on the Draft EIS.

If you should have any questions or comments please contact the undersigned at the above address or by calling (502) 564-3350. Please provide this office with a copy of the Final EIS once prepared. Thank you for the opportunity to comment.

Sincerely,

Valerie A. Wickstrom

Valerie A. Wickstrom
Environmental Review
Coordinator

VAW/jes

1984

12

Pesticides
Pest Coord.
Clerical
FO
FO
DFO
File

Christopher S. Bond
Governor

John A. Pelzer
Commissioner

State of Missouri
OFFICE OF ADMINISTRATION
Post Office Box 809
Jefferson City
65102

Perry M. McGinnis, Director
Division of Budget and Planning

February 10, 1984

Mr. Thomas N. Schenarts
Area Director
USDA Forest Service
P. O. Box 2417
Washington, D.C. 20013

Dear Mr. Schenarts:

Subject: 84010056 - Draft Environmental Impact Statement
USDA Gypsy Moth Suppression and
Eradication Projects

The Missouri Federal Assistance Clearinghouse, in cooperation with state and local agencies interested or possibly affected, has completed the review on the above project application.

None of the agencies involved in the review had comments or recommendations to offer at this time. This concludes the Clearinghouse's review.

A copy of this letter is to be attached to the application as evidence of compliance with the State Clearinghouse requirements.

Sincerely,

Lois Pohl

Lois Pohl, Coordinator
Missouri Clearinghouse

LP:cm

DANIEL F. READ
5707 WAYCROSS ST.
RALEIGH, N. C. 27606

Feb 12, 1984

Thomas N. Schenarts
Area Director, USDA Forest Service
370 Reed Rd.
Broomall, PA 19008

SUBJECT: Draft EIS, Gypsy Moth Suppression and Eradication Projects

COMMENTS of Daniel. F. Read

p. 2: To what extent does the increase in acres defoliated represent better reporting as opposed to an actual increase in infestation? The EIS should at least mention the scale of reporting efforts and how this may/may not affect the totals reported. Otherwise, the obvious implication is not that the problem has gotten markedly worse, but has remained within expected parameters and the current figures are used only to exaggerate its actual dimensions. a

p. 3: What units are used in Table 1? Square miles? Square feet? I assume acres, but it should be specified. b

p. 11: Economic considerations need to be expanded. E.g., the Pennsylvania study surveyed only 2.2 million acres, or some 3500 sq. mi., or about 8% of the total area of the state. Was this the worst 8% - a representative 8% - by whom was it estimated and how? The economic data given are sparse and may indicate a problem much more serious than it actually is. c

p. 15: The additional alternatives of "parasite and predator management", & "release of sterile stages" are dismissed because they are "still undergoing field testing" and because of lack of demonstrated effectiveness. Yet from reading the "History of Gypsy Moth Control", pp. 4-8, it is apparent that none of the methods of chemical control has been especially effective. The continued existence of the problem bears eloquent witness to this failure - yet implicitly, by not grouping chemicals with those alternatives ~~of~~ which lack demonstrated effectiveness, USDA tells us that chemicals are demonstrated effective. This is bad policy and will undoubtedly lead to additional human health problems. d

p 26: Monitoring procedures should include some sort of human health effects monitoring. Establishment of a computer data base, with cancers/cancer deaths matched by county with chemical application, should be fairly inexpensive and should give a helpful indicator of potential long-term effects. Of course, base line studies need to be done in the affected areas. e

p. 37 ff. The environmental consequences of the various chemicals include no long-term health effects in humans. Are there such studies? As the Maine viral potentiation data indicates, there are still many unanswered health questions. In light of the continued failure of the chemical solution, and in light of these unanswered questions, a serious public health question over the advise-ability of using chemicals arises. Predator and parasite management would seem to me to be the alternative of choice. f

p. 37ff What happens after the spraying is over? I understand from the EIS that pregnant women, etc. are safe if they stay inside during spraying. Does this mean there is no danger from handling car doors, lawn chairs, clothespins, doorknobs, etc. that are exposed to the spraying? This issue should be addressed (i.e. exposure from secondary sources) in the EIS. g

Thank you for the opportunity to comment.

Sincerely,

FEB 1 6 198 **14**

VICTOR ATIYEH
Governor

Executive Department

155 COTTAGE STREET NE., SALEM, OREGON 97310

February 13, 1984

Thomas N. Schernarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

SUBJECT: Gypsy Moth Suppression & Eradication Projects
PNRS#: OR840131-072-4
Due Date: 3-2-84

This is to notify you that the State Clearinghouse requests an extension of review time.

We will attempt to expedite matters in order to cause you the least possible inconvenience.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter

Dolores Streeter B.H.
Clearinghouse Coordinator

DS:bm:dl
1545T

Federal Emergency Management Agency
Special Facility
Post Office Box 129 Berryville, Virginia 22611

OP-FM-FE-MO February 17, 1984

MEMORANDUM FOR: Richard S. Newman
Chief, M&O Branch

FROM: Cecil E. Burke *Cecil E. Burke*
Chief, Sanitation Section

SUBJECT: Comments on the gypsy moth suppression and eradication projects proposed by the USDA

I favor the Integrated Pest Management alternative for gypsy moth control in our Mt. Weather vicinity.

Within the IPM approach:

1. Possibly less emphasis should be placed on chemical insecticide treatment because of the ill effects on beneficial insects and other life forms. Chemicals give only short term results. People become apprehensive when they see aircraft spraying large areas.

2. Working with the county extension agent to take advantage of his resources and communication with county residents would be worthwhile.

3. When one reckons with the number of acres to be treated, the estimated $20/acre cost of "disparlure" will not be attractive to those who must bear it.

Highlands Watershed Association

P.O. BOX [redacted]51

[redacted], NEW JERSEY [redacted]

West Milford 07480

February 20, 1984

Robert L. Williamson, Director
National Program Planning Staff
USDA Animal and Plant Health
Inspection Service
Federal Building
Hyattsville, MD 20782

Dear Mr. Williamson:

The 1984 Draft Environmental Impact Statement, USDA Gypsy Moth Suppression and Eradication Projects, is written in such vague terms as to obscure the expected impact of suppression and eradication projects. In almost all components of the proposal it is not clear if the USDA is suggesting unenforceable guidelines for participating states to follow or if you are presenting rules for states to follow to qualify for funding. The following are some specific questions and comments:

1) Why is it necessary to issue an EIS in 1984 when it was not deemed necessary in 1983? a

2) Why has an eradication component been added this year? (Previous recent impact statements and the 1983 Environmental Assessment refer only to suppression and regulatory projects). What are the eradication methods and how do they differ from suppression methods; specifically, are chemical alternatives the only ones used and is the amount of chemical increased? A previous EIS described the failure of past eradication programs and the subsequent enlightened suppression approach taken by the USDA. What new information is available to justify reversing this position? b

3) There is no section describing the planned projects and environmental impact in each state requesting Federal assistance for 1984 cooperative gypsy moth suppression and eradication projects. c

4) Do participating state agencies have to follow all suggested guidelines? If not, requirements must be delineated. What, if any, penalties will be assessed if requirements are not followed? d

5) Pg. 11 "Economic losses on this forest alone were estimated to be more than $3 million..."(Stokes State Forest-NJ) Is this estimate based on actual losses or theoretical losses (if all trees were actually harvested)? e

6) Where have successful eradication projects been implemented? What is the criteria for approving eradication projects? f

7) What are the Forest Service/APHIS yearly projections for the next 10 years of defoliation and spreading to new areas? (Please indicate projections for each of the four alternatives). g

8) What are the specific difficulties that the Forest Service and APHIS expect to have meeting statutory authorities contained in the Cooperative Forestry Assistance Act of 1978 and the Plant Quarantine Act of 1982, as amended if the NO Action alternative is used? (Pg.16) h

9) Pg.17 What are the specific degrees of effects on nontarget insects
for each insecticide formulation and mitigating measure used in i
USDA/State cooperative projects?
10) Pg.20 "The biological insecticide alternative would be justified
where special environmental concerns have been identified, and where j
absolute protection of host foliage and a reduction in gypsy moth
populations are not required." What are the special environmental
concerns? What will provide <u>absolute</u> (100%) protection? At the top of
the page you state that "application of biological insecticides can be
expected to achieve maximum effectiveness." At the bottom of the
page you state that biologicals will not reduce populations. Which
is correct?
11) Pg.21 "Areas where parasites or other natural controls are exerting
adequate biological pressure on gypsy moth populations probably would k
not receive insecticide treatment." Under what circumstances would
such areas receive insecticide treatment?
12) Pg. 22 You state that early public involvement in selection of
treatment areas will be used where appropriate. Where is it appropriate l
and how will this be accomplished?
13) Pg. 23. Are proper protective clothing and safety measures required
for those mixing and applying insecticides? What are the safety plans m
for pesticide spills, worker exposure or other potential accidents?
14) Pg. 23. How do local residents decide whether or not to participate? n
15) Pg. 23. The description of eradication treatment areas could
describe suppression treatment areas. What is the specific criteria o
differentiating these treatment alternatives?
16) Pg. 23. "Cooperating agencies are advised to use the local news
media and public meetings to involve the public..." Why not required? p
17) Pg. 24) "Treatment area selection criteria are similar for pro-
jects on Federal lands." What are the differences? q
18) Pg. 25. Considering the tremendous drift in high wind application
why not make it mandatory that application not take place in windy con- r
ditions?
19) Pg. 25. "Generally, insecticide application should not be attempted
when temperatures exceed 80°F." When is it acceptable to apply at s
temperatures above 80°F?
20) Pg. 66. Is the Public Notification and Involvement section manda-
tory? "For gypsy moth suppression activities on private land, residents
can opt out of the proposed project." I interpret this to mean that t
participating state agencies must provide a means of identifying those
residents who do not want their property sprayed and must comply
with their wish not to be sprayed. I congratulate the USDA on this
positive step toward protecting private property rights. However,
I see a potential for agencies to abuse the eradication designation
to forcibly spray those people wishing to opt out. Therefore, the eradi-
cation criteria must be clearly defined and justified by the USDA.
21) Pg. 66. You state that specifics on public participation and noti-
fication procedures will be developed during site-specific environmental
analysis. This is the sort of material that must be presented in a DEIS u
for public comment. Too much of this DEIS is similarly vague and not
suitable for comment in its present form.

Sincerely, Paul Twerdowsky

Paul Twerdowsky
Project Chairman

Highlands Watershed Association

P.O. BOX 51
[redacted], NEW JERSEY [redacted]
West Milford 07480

Please include the Highlands Watershed Association on the USDA mailing list. Note the change in address indicated above.

RCVD. FOSS 2-28-84 9711

17

FRIENDS OF THE EARTH

20 Feb.'84

Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

and

Robert L. Williamson, Director
National Program Planning Staff
USDA Animal and Plant Health Inspection Service
Federal Building
Hyattsville, MD 20782

Dear Messrs. Schenarts and Williamson:

Subj: Comments on Gypsy Moth Suppression and Eradication Projects DEIS.

Unfortunately, time constraints and other commitments preclude detailed review and comment on your gypsy moth suppression and eradication projects DEIS by this office. However, the limited review which we have made raises serious questions in our minds regarding the quality of analysis in and the sufficiency of the DEIS. In general, this draft EIS strikes us as being simplistic and reflecting the traditional bias of the USDA in favor of the use of chemical insecticides.

Our specific comments on this DEIS are as follows:

1. In the introduction on page one it is asserted that this DEIS will be used as a guide and that actual suppression and eradication activities will be based on the results of site-specific analyses conducted in the future. We hope that such site-specific analysis will be properly done. In the past, we have seen purported site-specific analysis prepared by the USDA which were totally inadequate to perform the intended function (cursory documents on the order of one page in length). a

2. The failure of earlier policies to check the natural spread of the gypsy moth in the northeast should provide an object lesson for the USDA with regard to other areas of the country where the policy is still "eradication". Entomologists we have discussed this situation with and even representatives of the USDA have agreed that "eradication" is an unrealistic long-term goal. b Intervention strategies that fail to recognize this cannot be expected to be successful and result in raising inappropriate expectations. It is doubtful that human intervention efforts will be determinative with regard to the ultimate spread of the gypsy moth throughout the US. It is much more likely that natural factors will be and that eventually natural controls will take effect. Effort should be spent in rational analysis and research designed to elucidate this situation and how best to tailor human intervention efforts to coordinate with it.

Northwest office 4512 University Way NE Seattle, Washington 98105 (206) 633-1661

3. Whether or not there is a need for gypsy moth control actions is a question that is poorly dealt with in the DEIS. The "no action" alternative appears to be an attempt to make a case based primarily on the natural aversion c
many people have to insect life stages and the extreme circumstances of the northeast. Whether or not the gypsy moth poses a credible threat to the west coast is a question that is not addressed with serious thought or research. The west coast and the Pacific northwest in particular presents a much different environment for the gypsy moth than the northeast. Although there are suitable host species present, no effort is made to analyze what is known about the complex set of factors that differentiate this area from the northeast and how they are likely to affect the gypsy moth which has now been in this area for at least ten years. Neither is any effort made to transfer information from what is known about climate, the particular set of vegetation patterns, or the interactions of other insect species in this environment.

4. After making an argument against the "no action" case based on the poor analysis in the DEIS discussed above, it is argued that prompt eradication efforts are necessary to avoid the catastrophic situation described for the northeast. d
Whether or not such a situation is likely to occur in the west and whether or not human intervention can avoid it if it is, in the long-term, are questions not dealt with in the DEIS. If human intervention will not ultimately be effective and natural factors will prevail, there seems to be no reason for eradication. In that case, scarce resources might be better utilized for monitoring programs and such limited suppression programs that might eventually be found to be necessary. Current USDA policies that do not make federal funds available for eradication programs in the west this year would seem to be tacit recognition of this point (if the acid test of USDA rhetoric is consideration of where the agency is willing to put its funds).

5. The presentation regarding the effects of chemical insecticides is generally simplistic, biassed to minimize the risk of chemical insecticide use, and emphasizes acute toxicity effects. For example, the persistence of chemical e
insecticides is stated to be short (e.g., "The half-life of carbaryl residues is 3 to 4 days") when there is information to the contrary, some of which is even included in the DEIS in a less predominant manner (e.g., carbaryl must still be present at significant levels if it is causing mortality of gypsy moth larvae 114 days after application). There is information in the literature which indicates that much of the purported data on pesticide persistence may be erroneous due to failure to account for translocation, incomplete analytical detection, and bound but still biologically active residues (carbaryl has been specifically mentioned in this literature). The discussion of the public health risks of acephate and diflubenzuron is totally oriented towards acute effects without even mention of other considerations (i.e., behavioral effects, carcinogenicity, mutagenicity, or teratogenicity). The discussion of trichlorfon is only marginally better since it is at least mentioned that this pesticide was found to be mutagenic "in several... studies" as well as teratogenic "at high doses". The USDA should be aware that acephate was found to produce genotoxic effects in the same testing in which trichlorfon was determined to be mutagenic and that in both cases this was more than simply "several" studies. In a screening battery of eleven tests trichlorfon was found to be positive in nine and acephate in seven. Both pesticides were categorized as displaying "extensive genotoxic activity" which made them of "greatest concern... as regards their potential effects on humans". It was also pointed out in this research that their was no correlation between the relative acute toxicity and genotoxic activity (your attention in this regard is directed to the 1982 report "Study of Pesticide Genotoxicity" by Waters, et al., produced by the U.S. Environmental Protection Agency's Health Effects Research

Laboratory). The discussion regarding the public health risks of carbaryl is the most complete of any of the chemical pesticides. Although more could be said on the topic and the risk is not fully presented, there is considerable information in the presentation which points to risk and informs the intelligent reviewer that this is a pesticide that poses unacceptable hazards (e.g., carbaryl may be teratogenic, is implicated in viral potentiation, and can result in the formation of mutagenic and carcinogenic compounds whether it causes these effects prior to transformation or not). Unfortunately, there is considerable effort in the DEIS to imply that the failure of other federal regulatory agencies to take action with regard to carbaryl has some substantive meaning regarding the risks of carbaryl.

6. The DEIS fails to fully satisfy the "worst case analysis" requirements of 40 CFR §1502.22 with regard to the environmental and public health risks of the use of chemical pesticides. **f**

7. The DEIS fails to address the fact that the use of B.t. has proven efficacious in both suppression and "eradication" projects in the past two years ("eradication" is here defined in comparison with arbitrary USDA definitions and the use of chemical insecticides rather than with any concept of reality regarding the long-term occurrence and spread of gypsy moths). The experience in Washington state in 1983 is good evidence that B.t. is just as effective in "eradication" efforts as any of the chemical insecticides. Given the comparable costs and efficacy, there is no justification for the use of chemical insecticides and no need to accept the environmental and public health risks that use entails. **g**

8. The USDA has mistated the meaning of IPM in choosing it as the preferred alternative. The IPM concept implies that there certain reasoned approaches used in pest management. These include the rational analysis of situations, determinations of pest thresholds below which no action is appropriate, and the use of chemical insecticides only as a last resort where there are important reasons for action and other nonchemical alternatives are either not available or ineffective. We believe that the selection of the IPM alternative is appropriate only if it is properly defined. Otherwise it becomes merely another rationale for the use of chemical pesticides. IPM does not mean that all methods of pest control are utilized. In this case, we believe that IPM would essentially mean that chemical pesticides are not used but that most other methods are used to some degree. The emphasis should be on development of natural factors to control gypsy moth populations, determination of real threats and pest levels requiring additional actions, and the use of B.t. where a pesticide is determined to be necessary. There is no apparent justification in the DEIS for any other approach and it would be inappropriate for the USDA to define IPM otherwise. The information in the DEIS clearly shows that B.t. is cost-effective and should be used in any case where a pesticide is determined to be necessary. **h**

Thank you for this opportunity to comment. We would appreciate your consideration and incorporation of our comments into the final EIS. We would also appreciate notification of the outcome of this process, a copy of the final EIS, and notification of any further plans of the USDA with regard to gypsy moth control in the Pacific northwest. In particular, please send us copies of any proposed site-specific assessments prepared for this area.

Sincerely,

GM Zemansky

G.M. Zemansky, Ph.D.

FEB 2 3 1984

18

4116 Arckelton Drive
Raleigh, NorthCarolina 27612

February 20, 1984

Mr. Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, Pa. 19008

Re: Gypsy Moth Suppression and Eradication Projects Draft Environmental Impact Statement

Dear Mr. Schenarts:

I am one of those people mentioned but dismissed in a few sentences on page v Summary Draft Environmental Impact Statement USDA Gypsy Moth Suppression and Eradication Projects. I. E. an individual who "exhibits extreme sensitivity to pesticides or other chemical or environmental substances." It is stated that such persons represent isolated cases. I would not call 21% of the U. S. population isolated cases. In the Raleigh-Durham-Chapel Hill area in which I reside there are 25 such persons known to me and many others whom I do not know. a

All of your toxicological information on the chemical substances mentioned in the EIS are based on oral or tactile exposures. A major danger of pesticides and their other ingredients is through vaporization. This problem is simply not dealt with. As an example, I live just behind a large apartment complex. They do quite a lot of manual spot spraying of herbicides and some pesticides. Please note this is not aerial spraying as is usually the case in gypsy moth programs. They notify me when they are going to spray and through painful trial and error I determined that I must stay in my completely closed up home for 48 hours in order not to be affected by vapors from their spraying. The number of people with sensitivities of this type is growing everyday. The reason for these sensitivities is that our immune systems have been damaged by chemicals such as these. To state "Implementation of the chemical insecticide treatment alternative will not result in any irreversible or irretrievable adverse environmental impacts" is a complete disregard for almost ¼ of the U. S. population. Further since it is impossible to undertake such programs, at least aerially, and insure no spray drift: and since the law clearly states that Spray Drift is Illegal, such programs are in violation of the law. b

Mr. Thomas N. Shenarts Feb. 20, 1984

Your own tests and statistics show B. T. to be completely safe and effective. There is no reason whatsoever to continue poisoning citizens with chemical pesticides other than the financial enrichment of the manufacturers of these products. c

The history of the gypsy moth on pages 4 to 8 of this EIS clearly demonstrates the ineffectiveness of chemical insecticides. And no clear economic benefit is demonstrated to support the use of chemicals over other methods. d

Common sense dictates that an IPM approach which excludes the use of chemical insecticides is the safest and sanest way to approach the gypsy moth problem. And, it is at least competitive from a cost-benefit standpoint. e

In 1982 the Milbrook area of Raleigh was the site of a spot infestation of gypsy moth. Largely because of my presence, a program of two aerial sprayings of B.T. and extensive trapping was used very effectively. f

In my opinion, chemicals are unnecessary and should not be used against gypsy moth. g

Sincerely,

Helen V. Moore

Helen V. Moore

FEB 23 1984

19

SIERRA CLUB ATLANTIC CHAPTER

800 Second Avenue New York, New York 10017 (212) 687-7666

February 20, 1984

Mr. Thomas N. Schenarts
Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19088

Mr. Robert L. Williamson
Director
USDA Animal and Plant Health
Inspection Service
Federal Building
Hyattsville, MD 20782

Dear Messrs. Schenarts and Williamson:

The Atlantic Chapter of the Sierra Club represents 24,000 members of the national organization in New York State. Our comments on the DEIS for USDA Gypsy Moth Supression and Eradication Projects, on which comments are due by February 25, are as follows.

We find that the DEIS is deficient in a number of areas. First, there is no specific information in the report about the number, scope and cost of USDA eradication and supression projects on federal lands or for those conducted in cooperation with state and local agencies. It is difficult to know, therefore, exactly what the proposed action is. The FEIS would benefit by including such information in the section on USDA participation (see pages 12-14). a

Second, it is clear that with 28 million acres having been defoliated in the 1980-1983 period (12.8 million in 1981 alone), that whatever supression activity is undertaken will affect only a small portion of the total area that is infested. However, when discussing APHIS eradication projects, for infestations in outlying isolated areas, the DEIS gives the reader the impression that containment in the Northeast and Michigan is a real possibility. Based on all past experience, including that of trying to establish a "break" at the Hudson River Valley beginning in 1922, containment is not a practical program goal. The DEIS should state more clearly that b

eradication of isolated infested areas outlying the Northeast and Michigan is a delaying tactic at best. The same applies to quarantine activities. The gypsy moth will continue to spread and the only thing that the APHIS eradication program does is to buy time. However, without having details about program scope and costs, it is difficult to evaluate the cost effectiveness of the APHIS program.

Third, there is no discussion of the fact that from the viewpoint of forest ecology, the chief effect of the gypsy moth is to speed c
up the normal cycle of decay and renewal. The emphasis in the DEIS is all on "crisis information" about estimated timber losses. Such data is highly theoretical and this should be stated. A more balanced presentation would be useful.

Fourth, the Atlantic Chapter of the Sierra Club has repeatedly mentioned, in our comments and letters on this program, that one of the biggest problems with federally-funded supression projects in d
New York has been that there has been no attempt by the Department of Environmental Conservation to embody procedures for the program in regulations and make them well-known to the public. No standards have been set for an exemption process, an equitable notification procedure, or buffer zones. Without adequate guidance on such matters, public confusion and chaos are sure to result. People will be sprayed who don't want to be sprayed. This is the biggest single factor affecting New York's participation in the program, yet it is not addressed under "Major Issues" and the USFS seems to have abdicated responsibility for holding the states to procedural standards.

Fifth, the DEIS states that the lack of a coordinated state program will result in applying more insecticide than necessary to supress or eradicate gypsy moth populations. This may be true in e
that most property owners will be forced to rely on ground spraying if there is no state-coordinated program. Heavier dosages will be needed than with aerial spraying even though far fewer acres are likely to be treated. However, this points up an even greater need for homeowner education and for effective regulation of commercial applicators, including establishment of adequate notification procedures for property owners adjoining those to be sprayed. None of this is discussed in the DEIS. USDA should be setting some standards for the states in this area.

Sixth, we find statements like the one in the second paragraph f
on page 32 to be very misleading. Even if every level of government takes action, there will still be defoliation and tree mortality because of the vast number of acres that are infested compared with the number of acres which can be treated.

Finally, this particular DEIS may not be the place to do it, but we believe that USDA should be placing much greater emphasis on g
educational aspects of state-local programs and providing federal

funding for these activities as well as setting some standards for state and local programs in the form of guidelines. This would be a far more effective use of taxpayer's monies than the present subsidy for aerial spraying of chemical and biological material to protect "forested subdivisions" and related homeowner's ornamentals on private property. Homeowner's should protect their own property, as should the owners of larger commercial properties (resorts, etc.) Because only a relatively few acres of the total that are infested in the Northeast and Michigan can be sprayed by air, such subsidization of supression activity is not efficacious or equitable and it should cease.

Thank you for the opportunity to comment on the DEIS.

Sincerely,

Richard J. Fedele

Richard J. Fedele
Chairman, Conservation
Committee

cc: H. Williams

FEB 2 7 1984

4 Crawford Road
Morris Plains, N.J. 07950
February 20, 1984

Thomas N. Schenarts
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schenarts:

My name is Jeffrey Coleman. I am a liscensed pilot currently flying out of the Morristown Airport. My experience in flying single and multi-engine aircraft has prompted me to comment on their use in the application of insecticides in the Gypsy Moth Eradication and Suppression Projects for inclusion in the Final Environmental Impact Statement.

Though fixed-wing aircraft are hightly maneuverable, a term which varies from aircraft to aircraft, their maneuverability decreases as their airspeed decreases. Of course, the slower the aircraft can go, the better control will be in the application of insecticides. A light single-engine aircraft operating "close to the tree canopy" (EIS p. 24) possibly between 25 and 50 feet, could not safely fly any slower than 60-70 mph. At that speed the maneuverability of the aircraft is greatly reduced.

I have observed crop dusters using aircraft to apply fertilizers and insecticides and when they operate close to the ground they don't want sluggish control response, so they travel faster than their slowest possible speed. The extra speed reduces the pilot's ability to control where the substance goes.

A multi-engine aircraft would need to travel even faster and therefore further reduce the control.

A helicopter does retain its maneuverability at slow speeds, can be flown closer to the tree tops, and would offer the best control for application, espcially near shutoff boundaries (which would be difficult for a fixed-wing aircraft due to the faster flying speed).

An observer plane to indentify exclusion areas and monitor the release of insecticide is a good idea but would not be able to readily determine from a distance where the substance is dropping. Possibly if the insecticide was colored this could be achieved to a greater extent.

An observer aircraft would be useful in indentification of exclusion areas to direct a helicopter to stop spraying or to turn back as a boundary is reached, but even with a helicopter,

spillover into the exclusion areas would occur all along the boundaries.

It is my opinion based on practical experience and my education (Bachelors in Flight Technology from Perdue University) that aircraft can not offer enough control to segrate between areas that should be treated and those which should be excluded.

Jeffrey L Coleman

FEB 2 4 1984

Federal Emergency Management Agency
Special Facility
Post Office Box 129 Berryville, Virginia 22611

February 21, 1984

Mr. Thomas N. Schenarts, Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schenarts:

Mr. Cecil Burke of the Special Facility Sanitation Section has reviewed the subject document. His comments are attached for your consideration. Any future contact with the Special Facility regarding this subject can be directed to Mr. Burke, telephone number: 703-662-9201, Ext. 5775.

Please advise if we can be of further assistance as we are very interested in this important program.

Sincerely,

Bernard T. Gallagher

Bernard T. Gallagher
Assistant Associate Director
Office of Facilities Management

Attachment

FEB 2 7 1984

22

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

HARRY HUGHES
GOVERNOR

CONSTANCE LIEDER
SECRETARY

February 21, 1984

Mr. Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

SUBJECT: REVIEW AND RECOMMENDATION

State Identification Number: MD 84-1-262

Applicant: U.S. Department of Agriculture

Description: DEIS - Gypsy Moth Suppression & Eradication Projects

Recommendation: Endorsement

Dear Mr. Schenarts:

The State Clearinghouse has coordinated the intergovernmental review of the referenced subject. Acting under Article 88C of the Annotated Code of Maryland and Code of Maryland Regulations 16.02.03, the State Clearinghouse received the following comments:

Department of Agriculture, Department of Natural Resources, and the Department of State Planning indicated that the statement appears to adequately cover those areas of interest to their agencies.

The State Clearinghouse should be kept informed of any decisions made with regard to this subject. The Clearinghouse recommendation is valid for a period of three years from the date of this letter. If a decision regarding the subject has not been made within that time period, information should be submitted to the Clearinghouse requesting a review update.

We appreciate your attention to the intergovernmental review process and look forward to continued cooperation.

Sincerely,

Guy W. Hager
Director, Maryland State Clearinghouse
for Intergovernmental Assistance

GWH:hd

cc: Herbert Sachs
Clyde Pyers
Lowell Frederick
Max Eisenberg
Stephanie O'Hara (83-301)
Scrib Sheafor
Jeff Bresee
Wayne Cawley

FEB 24 1984

23

TENNESSEE DEPARTMENT OF AGRICULTURE
Division of Plant Industries
Ellington Agricultural Center
Box 40627, Melrose Station
Nashville, Tennessee 37204

February 21, 1984

Mr. Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Re: Gypsy Moth Suppression and Eradication Projects DEIS

Dear Sirs:

I would like to comment on the lack of information on buffer zones around sensitive areas. These were outlined in William N. Hedemon, Jr.'s (Director, EPA Office of Environmental Review) letter of comment on the 1980 EIS (DA# 80-10-copy enclosed). I believe that these guidelines should be recommended as a minimum for use, regardless of whether or not the public information process was used, especially since most pesticide labels do not specify the size of buffer zones. I realize each situation is different, but the EPA comments do at least provide a rule-of-thumb to go by when setting a spraying program.

In our own Gypsy Moth situation in Tennessee, we are faced with treating around a municiple water supply. Assurance to the local water authority officials that these EPA guidelines would be followed was well received.

Sincerely,

Michael E. Cooper

Michael E. Cooper, R. P. E.
Survey Entomologist

MEC/gb

Citizens For A Better Environment

22 February 1984

Robert L. Williamson, Director
National Planning Staff
USDA Animal Plant Helath Inspection Service
Federal Building
Hyattsville, MD 20782

RE: Gypsy Moth Suppression and Eradication Projects:
Draft Environmental Impact Statement

Dear Mr. Williamson:

The draft Environmental Impact Statement (dEIS) for 1984 gypsy moth suppression and eradication projects is the most thoughtful of such evaluations performed by USDA. A thorough and adequate assessment of gypsy moth programs is extremely important. Citizens for a Better Environment has recently sued the California Department of Food and Agriculture for refusing to formally a
evaluate gypsy moth eradication efforts in a manner that facilitates public input. I've enclosed a copy of our petition for a Writ of Mandate regarding our suit. I request that you consider these concerns in your project evaluation. The attached declarations from entomologists, toxicologists and spray area residents should be of interest.

Several important areas merit further discussion in the final gypsy moth Environmental Impact Statement:

Pesticide Efficacy

The lack of evaluation of the efficacy of available treatment options is a peculiar deficiency for a USDA document. USDA generally advocates the use of the most apparently efficacious treatment. Chemical pesticides have often been favored over alternative methods and materials which may be of less concern to human health and the environment.

The public generally favors biological insecticides, pheromones, and other methods of gypsy moth control and possible eradication which avoid chemical pesticides such as carbaryl. *Bacillus thuringiensis* b
is widely used in suppression projects and more recently eradication efforts in Illinois and Washington State. The efficacy of B.t. and other alternatives should be more specifically contrasted with carbaryl.

Does the USDA believe that B.t., or B.t. in combination with other non-chemical pesticide strategies, presents a reasonable alternative to c
carbaryl for gypsy moth eradication? If not, why? What specific data exists on the efficacy against gypsy moth of the various materials available? How is control project data (high population suppression) applicable to eradication situations?

942 Market Street, Suite 505, San Francisco, California 94102 (415) 788-0690

citizens for a better environment

Eradication vs. Control

Eradication should be explicitly contrasted with a policy of suppression. Michigan is attempting to eradicate apparently isolated infestations and leaving the generally-infested areas of the state unsprayed. South Carolina is attempting control of the general infestation and simply monitoring lower-level populations in the state. Eradication has frequently failed, yet apparently been successful in other instances. What criteria are used in selecting eradication vs. control? How is the decision made? Is there a difference between control and repeated attempts at eradication? Who decides what strategy shall be pursued? What criteria are used to evaluate the success of control or eradication efforts? How is a decision made to switch from eradication to control? d

Eradication of Isolated Infestations

The recent history of attempts to eradicate isolated infestations should be discussed. Gypsy moths have been found in the 1982 Salem carbaryl treatment area in both 1982 and 1983. Finds were made in some areas of Washington State treated with B.t. Moths were found near, but apparently not in, California communities recently sprayed with carbaryl. Each state plans to again treat certain areas. Where have isolated gypsy moth populations been found since about 1965? What have been the results of attempts to eradicate these populations? Where do apparently isolated infestations currently exist in the United States? e

IPM vs. Chemical Control

Integrated pest management (IPM) can employ a combination of chemical or non-chemical management strategies based on a rational decision-making process. Why is IPM considered less effective than chemical control? Was the 1981 Santa Barbara project which combined carbaryl, B.t. and traps believed to be less effective than carbaryl alone? How do you evaluate whether carbaryl is more effective in eradicating gypsy moth than B.t. or B.t. and traps? f

IPM is a process which includes deciding whether to treat, when, where and how a program will be conducted.

Given NEPA and USDA regulations, does the Department have any choice other than to employ IPM?

Alternative Strategies

What specifically have been the results of control or eradication efforts not relying on chemical or biological pesticides? Mass trapping alone has apparently been successful in Appleton and Monona, Wisconsin. What is the efficacy of this technique and why is it not detailed in the dEIS? Where have pheromone applications been employed and what is the efficacy of Disparlure? What is the status of sterile insect release projects which have been conducted in Michigan and South Carolina? What is the efficacy of insecticidal soap which was employed in Vancouver, British g

Citizens For A Better Environment

Columbia? What specifically is the status of these non-pesticide alternatives and their potential for use in gypsy moth control or eradication projects?

Local Control

The dEIS points out that the choice of suppression methods is left to local jurisdictions. Do local communities have the right to choose the method of eradication? If not, why? If local government, the state and/or federal government disagree, who chooses what method will be employed? h

Long-Term vs. Short-Term

Is it stated that gypsy moth will continue to expand its range? What are the comparative long-term benefits and deficiencies of eradication vs. control for states not currently generally-infested? Do short-term eradication projects divert resources from long-term control efforts? i

Health Effects

The potential viral enhancement and teratogenicity of carbaryl and the mutagenicity and carcinogenicity of N-nitrosocarbaryl are discussed. The concern over birth defects is largely rebutted. Is it correctly stated that it is not possible to avoid exposing some persons to the pesticide applications and that some unidentifiable persons may be peculiarly sensitive? Why is it concluded that it is highly unlikely that carbaryl treatments pose a hazard? j

Table 2 on page 18 is much appreciated. The hazards of each individual pesticide are also discussed. In a narrative discussion, what are the comparative health and environmental hazards of the available pesticides? Isn't B.t. safer than carbaryl?

Citizens for a Better Environment appreciates the USDA's continued efforts to deal effectively with the difficult problems posed by the gypsy moth. Strides have been made in recent years to better respond to public concerns and develop gypsy moth management strategies which don't rely on chemical pesticides. The work at USDA's Otis Methods Development Center is particularly valuable.

Thank you for this dEIS and I look forward to informational responses to our questions and concerns in the final EIR document.

Sincerely,

Steve Dreistadt

Steve Dreistadt
Research Associate

Enclosures

FEB 2 4 1984

United States Department of the Interior
FISH AND WILDLIFE SERVICE
75 SPRING STREET, S.W.
ATLANTA, GEORGIA 30303

25

Febraury 22, 1984

Mr. Thomas N. Schenarts, Director
U.S. Forest Service
370 Reed Road
Broomell, PA . 19008

Dear Mr. Schenarts:

We have reviewed the Draft Environmental Impact Statement entitled "Gypsy Moth Suppression and Eradication Projects" and have the following comments:

We concur that the implementation of an integrated pest management (IPM) approach is the preferred approach. However, we strongly urge that the IPM approach be slanted as heavily towards the use of biological control as possible with as little use of chemicals as feasible. **a**

We recommend that the use of carbaryl be limited in watershed areas because of its high toxicity for aquatic invertebrates. **b**

In the final EIS, we recommend that you specify formulations when discussing the toxicity of acephate and trichlorfon such as was done for carbaryl in the DEIS. **c**

We question the statement on page 55 that trichlorfon . . . has shown no significant adverse effects against . . . fish. . . . The LC50 of trichlorfon (80 percent soluble powder) ranged from 0.7 to 9.2 parts per million for bluegill and various species of trout. (Johnson, W., and M. T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USDI/FWS, Resource Publication 137. pp. 78-79.) **d**

Thank you for the opportunity to comment on this document.

Sincerely yours,

David B. Allen

David B. Allen
Acting Deputy Regional Director

RCVD. FOSS 2-24-84

26

354 Hrubetz Road SE
Salem, Oregon 97302
February 22, 1984

Robert L. Williamson, Director
USDA Animal and Plant Health
Inspection Service
Federal Building
Hyattsville, MD 20782

Dear Mr. Williamson:

After reviewing the 1984 Draft Environmental Impact Statement we are left with the troubling impression that it leaves many questions and concerns unanswered. We appreciate this opportunity to comment on the DEIS.

There is a disturbing lack of discussion and disclosure of the fraud in laboratory testing of chemicals used in gypsy moth spray programs. The DEIS fails to disclose recent convictions of former officials from Industrial Bio-test Labs.. It also fails to discuss the EPA/FDA's partially completed audit of other private testing labs (which found serious problems in over 50 of the 80 labs audited before funds for the audit were cut off by the current administration). How does the fraud in lab testing affect the chemical insecticides which the DEIS sanctions for use in populated areas? Has the USDA undertaken an independent review of these questionable studies relied upon for pronouncing these chemicals "safe?" a

Why doesn't the DEIS state whether carbaryl is conditionally registered under FIFRA? Has the USDA independently reviewed the information submitted in support of carbaryl registration? b

Has the USDA or EPA identified gaps in the information used to register carbaryl? What are these data gaps and why are they not mentioned in the DEIS? c

Has the USDA undertaken research to determine whether carbaryl causes cancer, birth defects, or gene mutations? d

Why doesn't the DEIS contain a worst case analysis which examines what the consequences would be if carbaryl did cause cancer and birth defects? While not intending to scoff at the potentially deleterious effects a mammoth invasion of gypsy moths might bring, we notice that the DEIS goes to great lengths to portray an unpleasant scenerio of the consequences of no action, depicting deprivation even of access to golf courses. e

A proper worst case analysis would contain a discussion of a f
scenario in which a heavily populated area was sprayed with
carbaryl, carbaryl turned out in fact to cause cancer and
mutations, and a significant number of people (including
chemically sensitive people, children, and elderly people)
were exposed. The analysis would then list the numbers of
deaths from cancer that would be expected under the worst
case, and the number of genetic mutations that would result
in the worst case, including the effects these mutations
could have in future generations.

In performing this worst case analysis, the agency should not
assume that mitigation measures will work perfectly or indeed g
at all. The graphic proof that the worst case can in fact
occur may be seen from the Forest Service's debacle in attempting
to spray carbaryl in NE Oregon in 1983. There, literally
thousands of gallons of carbaryl were dumped directly into
a stream and numerous helicopter crashes occured. In other
words, the number of deaths and mutations calculated should
be based upon an assumption that significant exposure will
occur.

Viral enhancement attributed to carbaryl is mentioned on
page 50 of the DEIS. Why is there a complete lack of analysis h
of the potential for viral enhancement in humans in areas
sprayed with carbaryl? Should not the possibility of serious,
widespread viral epidemics and their potentially devastating
effects be examined (not only on the general population, but
also on those more vulnerable such as the very young, the
elderly, the unborn, those already in ill health, and the
chemically sensitive)?

The DEIS passes along some unsubstantiated advice to pregnant
women on page 50. It states that avoiding exposure to carbaryl i
is easily accomplished by "...remaining indoors or under suitable
cover at the time the application is made. Once the spray
settles, any further potential for exposure is greatly reduced,
and should be of no concern." However, in a sworn affidavit
Dr. Janette D. Sherman, a physician, researcher, analytical
chemist, and member of a 12 person Advisory Committee for
the EPA, stated, "In my opinion, the claim that people who
are indoors will receive a zero detectable dose of this
chemical is unsupportable."

In a related affidavit submitted by Dr. Ruth Shearer, molecular
geneticist and consultant in genetic toxicology, the issue j
of birth defects is discussed as follows: "Carbaryl has been
shown to cause birth defects in dogs, rabbits, and guinea pigs,
and to cause other reproductive effects in mice, rats, and
gerbils. Birth defects are caused by exposure to a reproductive
toxin at a sensitive stage of early pregnancy and do not
require prolonged exposure. The Council on Environmental
Quality recently compared effective doses of all eight chemicals
known to be teratogenetic in both humans and animals, and
determined that humans were the most sensitive species in all
cases (CEQ 1981)."

The statement on page 44 of the DEIS regarding carbaryl's "safety record" deserves special recognition for its arrogant disregard for the scientific process. It displays a disturbing lack of understanding of the chronic effects and the amount of time it takes for chronic effects to manifest themselves. Furthermore, the DEIS assertion that there has been almost universal exposure to carbaryl is directly inconsistent with its assurances that exposure can be minimized. The statement is made also that carbaryl exposure in the US has spanned over 20 years. Many long term effects such as cancer can occur as long as 20-30 years or more after exposure. Have any longitudinal health studies been done on humans exposed to this chemical, studies which follow their health for more than 20 years? One need only look at the tragic results such neglect caused in the case of asbestos. **k**

We are puzzled as to why the DEIS does not define bacillus thuringiensis as an eradicant when the Oregon Department of Agriculture is currently proposing the use of bt in its 1984 eradication program. The ODA points to its encouraging track record in other states as evidence of its efficacy. **l**

This DEIS persists in relying on the EPA registration of carbaryl as a basis for exonerating it from blame regarding health risks. Acloser examination of the RPAR process of the EPA is certainly in order. We seriously question the validity of the premise under which the DEIS seems to be operating; the premise that if a chemical is registered by EPA it presents little or no human health risk. **m**

To say that the 1980 Carbaryl Decision Document is flawed would be an understatement. No less than an environmental coverup seems to have occured in the issuing of that document. The EPA decision in 1980 to allow continued use of carbaryl provoked controversy even within the EPA. Our investigation into the decision making process resulted in gaining access to leaked internal memos and documents written by high ranking scientists within the EPA. We are submitting copies of these documents for your examination and response and wish to have them included as part of our comments regarding this DEIS. **n**

Questionable procedures were followed in issuing the Decision Document. It is supposed to be standard EPA policy to submit draft documents to the Pesticide Chemical Review Committee (PCRC) to allow for internal scientific peer review before it is made public. Instead of allowing this committee of scientists to review it, Union Carbide, manufacturer of the pesticide, was allowed to examine it. To quote from one of the leaked memoe, "<u>If there was time for Union Carbide to examine the document</u>, there should be time for the agency to review it, too" (emphasis original).

This same memo goes on to focus on the Decision Document: "Turning to the Carbaryl Decision Document itself, my staff reviewed it for scientific soundness and public health concerns we offer these comments.

1. In general, the conclusions in the Teratogenic and Fetotoxic Effects, Mutagenicity, and Gonadal Effects in Carbaryl-Exposed males sections do not appear to be justified by the studies and data presented. The data lead the reader in one direction, the conclusion in another." (emphasis in original)

We also obtained a document from within the EPA which is the second draft of the Carbaryl Position Document #1, dated Nov. 7, 1977. It makes for very interesting reading and we await your comments on it with interest. The following are quotes from that document (which was compiled by EPA scientists):

"On the basis of the teratogenic effects observed in the dog at low levels of carbaryl, as well as in four other species, and the fetotoxic effects observed in the dog and four other species, the Working Group has concluded that a rebuttable presumption against registration has arisen pursuant to Section 162.11 (a) (3) (ii) (B) against pesticides containing carbaryl."

Regarding home gardeners, the Document states, "...the anticipated level of exposure (0.1 mg/kg) and the lowest observed effect level for teratogenic effects in dogs (5 mg/kg) does not represent an adequate margin of safety. Therefore, a rebuttable presumption of teratogenic and fetotoxic risk from the use of carbaryl in all home garden formulations has been established."

The document continues to list the various exposures of carbaryl, such as orchard sprayers, forest uses, food residues, flea preparations for pets, field workers, and in EVERY instance declares that there is no margin of safety and that a rebuttable presumption of risk is established.

This document was obviously suppressed and not reflected in the final EPA Carbaryl Decision Document. As another memo succinctly concluded (dated 12/80): "This was a PURELY political decision by DAA to end the RPAR. The document clearly reflects the desire to get out of the RPAR the easiest way possible, evidence be damned." (emphasis original).

In light of the doubt cast on the validity of the registration of carbaryl even by EPA scientists, this DEIS is on very shaky ground when it continues to dismiss safety concerns on the basis of EPA registration.

An EIS is supposed to contain a hard look at the environmental consequences of a spray program, not publicize the virtues of the agency's preferred course of action.

Although undoubtedly an EIS must speak in terms of statistics when discussing spray programs, we must never forget that ultimately it is <u>people</u> who are being subjected to health risks against their will. If even one person develops cancer, if even one baby is born with birth defects as a result of your spray programs, that is one person too many. We do not wish to be victims of chemical roulette.

Sincerely,

Elaine M. Olsen

Elaine M. Olsen

Glen E. Olsen

Glen E. Olsen

Enclosures

RCVD. FOSS 2-24-84

February 22, 1984

27

Mr. Robert L. Williamson, Director
USDA Animal and Plant Health Inspection Service
Federal Building
Hyattsville, Maryland 20782

Dear Mr. Williamson:

We are writing to express concern over the DEIS for Gypsy Moth Suppression and Eradication Projects; the DEIS, as it now stands, appears to us to be seriously deficient in addressing the concerns articulated by the U.S. Ninth Circuit Court of Appeals in OEC vs. Kunzman (a case with which we were quite concerned).

To begin with, the DEIS is conspicuously biased in its assessments. We understand that an EIS or an EA must seriously consider the possible range of effects of environmental actions in order to be adequate, including a worst case analysis. This DEIS presents what might be construed to be a worst case analysis only for the first alternative--no action. In that section, the prose ceases to pretend to objectivity, becoming florid: "Their bodies rupture and the rotted fluid contents spill out, staining homes. Bacteria grow in the fluid, making the stench of a diseased population detectable from a distance " (p.34). Nothing in the consideration of the other alternatives inspires such poetic enthusiasm in the writers. a

The lack of evenhanded consideration is especially apparent to us, whose children are very sensitive to chemicals. The DEIS terms them "abnormally sensitive", which seems to us to be a means of avoiding agency responsibility by suggesting that the problem lies somehow only in us, and not also in the chemicals that may be sprayed on us. b

The current DEIS suggests quite rightly that it is impossible to identify in advance individuals who may be sensitive to chemicals used in eradication projects (p.37). For that reason, however, public notification merely that an area is to be sprayed is not adequate protection. Any persons with immunologic deficiencies, or any persons suffering from decreased liver functioning, might well be at risk without realizing it. So would persons with undiagnosed chemical sensitivities, among others. It is highly unlikely, for instance, that persons who have recently suffered from hepatitis, the parents of jaundiced newborns or heavy social drinkers will know that carbaryl must be filtered, detoxified and excreted by a normally functioning liver. It is also highly unlikely that most persons will either know about or understand the implications of carbaryl as a cholinesterase inhibitor (especially as the DEIS discusses it only in relationship to insects and birds). Thus public notification as it is now carried out will not necessarily protect persons sensitive to these chemicals, whether the sensitivity be allergic or otherwise. A worst case analysis, it would seem to us, should involve consequences for such high risk populations. c

Even if everyone at risk were to be fully informed, the DEIS fails to explore the ramifications. For example, the suggestion on page 37 that sensitive persons may avoid exposure by seeking shelter or leaving the area until all danger has passed fails to note adequately what such measures might entail. The ODA hearing record of 1982 will show that Union Carbide's own representative (Antoine Puech) had advised us, given our children's sensitivities, to leave our home for two to three weeks after each spray. A normal eradication program thus necessitates our leaving our home for five to eight weeks. d

On this issue again the DEIS is anything but evenhanded. It takes note of the grave consequences of untreated gypsy moth infestations, noting everything from "natural" fear of insects (as opposed to "abnormal" chemical sensitivity) e to traffic hazards posed by crushed larvae on the roads. On page 33, it notes sympathetically that some persons "have been denied the use of summer homes during the period in which larvae are feeding." Thus the suggestion that sensitive persons may simply leave the spray area, without noting what such advice entails, appears abnormally insensitive and cavalier. Treatment programs may well deny some persons the use of their <u>only</u> homes for extended periods. The only way that we can see to mitigate such problems is to allow individual property owners to opt out of eradication programs. Such property could be treated with non-chemical alternatives.

Beyond these concerns, this DEIS does not consider the increased dosage f level absorbed by children who may be in wide contact with sprayed ground and foliage. It does not consider the danger posed by accidental spills in urban areas--spills which experience has shown to be a normal danger associated with any aerial spray program. It does not address the dangers posed by possible crashes of spray aircraft over urban areas. It does not begin to suggest the extensive controversy that carbaryl in particular has engendered. A thorough critique of this DEIS in that area would necessitate volumes and lies beyond the intended scope of this letter.

Finally we note that this DEIS is based on the studies leading to the g original registration and the 1980 RPAR decision by the EPA. Where does this DEIS address the adequacy of this testing data? In the light of recent testing scandals, such an omission seems significant. Any EIS which fails to consider the adequacy of the testing data upon which it relies can hardly expect to command the confidence of the public.

Sincerely,

Janet G. Nolley

Janet G. Nolley

Kenneth S. Nolley

Kenneth S. Nolley
3358 Pringle Road S.E.
Salem, Oregon 97302

Resources Building
1416 Ninth Street
95814

(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Boating and Waterways
Department of Parks and Recreation
Department of Water Resources

GEORGE DEUKMEJIAN
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

28

Mr. Thomas N. Schenarts
U.S. Forest Service
370 Reed Road
Broomall, PA 19008

February 22, 1984

Dear Mr. Schenarts:

The State has reviewed the draft EIS, Gypsy Moth Suppression and Eradication Projects, submitted through the Office of Planning and Research. Review was coordinated with State Water Resources Control Board and the Departments of Fish and Game, Forestry, Food and Agriculture, and Health Services.

The Department of Fish and Game (DFG) supports the IPM approach to gypsy moth suppression and eradication. DFG has worked with the California Department of Food and Agriculture in developing risk assessments and monitoring pesticide residues for several pest eradication programs (Medfly, Mexfly, Japanese beetle, and gypsy moth). DFG recommends that the Pesticide Investigations Unit of DFG's Environmental Services Branch be consulted in any program led by the U.S. Department of Agriculture. In particular, DFG is interested in monitoring effects of pesticides in areas of biological significance.

The Pesticide Investigations Unit of DFG may be contacted at 1416 Ninth Street, Sacramento, CA 95814.

The Department of Food and Agriculture indicates that it will probably be commenting directly to you on this matter.

Thank you for providing this document for review and comment.

Sincerely,

Charles K. Fellows

for Gordon F. Snow, Ph.D
Assistant Secretary for Resources

cc: Office of Planning and Research
(SCH 84012305)

STATE OF CALIFORNIA—OFFICE OF THE GOVERNOR

GEORGE DEUKMEJIAN, *Governor*

OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO, CA 95814

916/323-7480

TO: Mr. Thomas Schenarts
U.S. Forest Service
370 Reed Road
Broomall, PA 19008

DATE: February 22, 1984

FROM: Office of Planning and Research
State Clearinghouse

RE: SCH 84012305---Draft EIS, Gypsy Moth Suppression and Eradication Projects, U.S. Forest Service.

As the designated Single Point of Contact for the State of California, pursuant to Executive Order 12372, the Office of Planning and Research transmits attached comments as the State Process Recommedation.

Initiation of the "accommodate or explain" response by your agency, therefore, is in effect.

Sincerely,

Huston T. Carlyle, Jr.
Director, Office of Planning and Research

NEW JERSEY COALITION FOR ALTERNATIVES TO PESTICIDES
P.O. BOX 627
BOONTON, NEW JERSEY 07005

FEB 2 7 1984

29

February 22, 1984

Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr Schenarts:

My name is Nancy Browne Coleman. I am a member of New Jersey Coalition for Alternatives to Pesticides, which is a state-wide organization comprised of local and national environmental groups as well as municipalities and concerned individuals. NJCAP promotes the use of alternatives to chemical pesticide use and seeks to promote an increase awareness and use of Integrated Pest Management and beneficial insects. This is accomplished by education of the public (and government agencies where needed) and lobbying on Federal, state and local levels.

As a member of the steering committee of NJCAP, I would like to submit the following comments on the "Draft Environmental Impact Statement, USDA Gypsy Moth Suppression and Eradication Projects":

The EIS seems to show quite a bias towards the absolute need for spraying to save the environment from the "destruction" of the gypsy moth pest. Even the interpretation of studies cited in the publication show the prejudice on the part of the preparers toward the chemical solution.

There is an abundance of evidence which show that the effects of the gypsy moth are rarely as dramatic as the authors would have us believe. Certainly the amount of public outcry against the use of broad-spectrum insecticides should warrant the use of only the biological controls and sprays when federal funds are used for a project such as these two projects.

It is embarrassing to read the preparer's sections on Integrated Pest Management. IPM is not a two part theory (monitoring and then spraying). If this is to what your programs(suppression and eradication) are reduced, then they cannot any longer be called integrated pest management! IPM tries to achieve the maximum use of naturally occurring pest controls, including weather, disease agents, predators and parasites...Artificial controls are imposed only as needed to keep a pest from reaching intolerable levels such as by spot treatments of "hot-spots" of heavy infestations (The IPM Practitioner, Vol. 2 No. 5, May 1980). a

I would like the following questions regarding the EIS answered:

* What was the source used by the USDA when it estimated that losses to homeowners forest industries and recreation areas ar $272 million. Have there been any studies at all showing loss to homeowners? b

* Is it possible to expect that isolated infestations will not become permanently established? Has anyone ever been successful in eradication the pest or will the country just have to live with infestations? (p. ii) c

* PUBLIC COMMENTS MUST BE INCLUDED IN THE FINAL EIS! The USDA MUST be req uired to show all interested parties the public's concerns and questions and how they are answered! Commission of the public's letters will be considered a break in the normal public input process and will be dealt with accordingly! Do not make this mistake or the USDA might feel the full impact of future legislation dealing with the removal of its authority in these programs! (p.ii) d

* Where have "chemical insectiides successfully achieved the desired project objectives in previous suppression and eradication projects."? (p.iii) e

* Why are the use of parasite and predator management not viable components? Are you not aware of New Jersey's use of these methods? (p.iii) f

* Why does USDA insist upon trying to stop the pest from artificial spreading when the gypsy moth continues and has continued to spread for decades no matter what has been attempted in their control? Wouldn't the public's money be better spent by funnelling into helping the homeowner cope with the moth by an education process and the use of traps, phermones, beneficial insect rearing and biological spraying of hot spots? (p.iv) g

* Is the USDA guaranteeing that there will be no irreversible or irretrievable adverse environmental impacts? (p. v) h

* What is the source for the statement that "larval nuisance and tree defoliation are likely to continue for several weeks after application."? According to studies from manufacturers and personal experiences of many users of B. t., mortality usually occurs from 3 to 7 days; isn't this more the case? (p. v) i

* Where is the discussion of issues ignored by the USDA such as overlapping of swaths of spray planes? possibility of synergistic effects of sprays? symptoms of pesticide poisoning and tests for and reporting of such cases? discussion of the fact that most formulations of pesticides used are not intended for use in home gardens, that harvesting schedules are needed for these substances? discussion of the fact that most pesticides are mixed with "carriers" or "stickers" (such as kerosene) prior to spraying? j

* Where is the discussion of all of the "Major Issues and Concerns" listed on pp. 9-10? These should have been discussed not just used as a guide! k

* If the goal of USDA is a quality environment, why does l
it condone the mass spraying of chemical insecticides upon our
environment? (p. 12)

* If the policy of the Forest Service is to enhance the m
quality of the environment, why does it not use the least harm-
ful substances to preserve the forest resources of the Nation? (p. 13)

* Isn't the goal of the APHIS/State cooperative regulatory
program an impossible dream? Does the USDA really believe that
they can accomplish something which has been tried (and with n
more toxic substances, such as DDT) and proven to be impossible
in the past? Why waste the taxpayer's money on programs which
pour millions of dollars down the drain and pounds and pounds
of toxic substances all over our environment? (p. 13)

* Don't the two programs in the EIS contradict each other? o
The suppression program admits that eradication is no longer being
attempted and the APHIS program tries to do just that!

* If the USDA doesn't commence the use of parasite and
predator management such as that practiced by states such as p
New Jersey and Pennsylvania, how does it expect beneficial insects
to become part of the program? (p. 15)

* If chemical insecticides have successfully achieved the q
desired objectives in previous eradication projects, how is it
that the pest has spread anyway? (p. 16)

* "Potential" larval droppings' allergic reaction is a
ridiculous reason to consider chemical insecticide spraying! r
Where are your studies to show that allergic reactions to
larval frass is problematic? (p.17)

* Where are studies showing that slippery roadways and
sidewalks are (or have been) a problem? Was this just sensational- s
ism used by the press and repeated in the EIS as if it were a
scientific observation? (p.17)

* Isn't it true that broad-spectrum insecticides affect
multitudes of non-target insects in the treatment areas, not t
just "some"? (p. 17)

* Isn't it true that even USDA laboratory tests have
shown that carbaryl residues can produce as high as 77% mortality u
rate for a broad spectrum of insects even after 63 days! (p.19)

* Where can it be said that *B. t.* does not give absolute
protection of host foliage and gypsy moth populations? Doesn't v
protection mean the prevention of tree mortality? Isn't this
accomplished by the use of *B. t.*? (p. 20)

* People living and frequenting areas outside spray treatment areas will also be subject to spray drift; how does USDA propose to protect these citizens from unwanted and uninformed spray exposure?(p.22) w

* Shouldn't public notification by individual letter or contact to assure awareness be a requirement of the individual states instead of a suggestion? (p.22) x

* If local residents are to decide shouldn't the question as to whether treatment is needed or wanted be left up to the consensus of the population in the local area instead of allowing a local town council the right to declare "the gypsy moth a public nuisance" and thereby take away the rights of the populace to decide whether they want their properties treated or not and whether they want their tax money to pay for such a program? (p.23) y

* Fixed-wing aircraft or helicopters are not highly maneuverable over suburban areas! This is the reason that so many mistakes are made! How can USDA claim that insecticide shutoffs can be managed in these areas where it is almost impossible for the pilot of an aircraft to see that he is applying a contact poison in the correct areas? (p.24) z

* Shouldn't weather balloons be mandatory? (p.25) How else can aircraft operators readily see target areas? aa

* When temperatures rise, don't inversion layers cause the insecticide to become airborn? (p. 25) bb

* Shouldn't observer aircraft be a requirement?(p.26) cc

* Isn't it ridiculous to be talking about eradication projects when 3 paragraphs before the EIS talks about its (the gypsy moth's) <u>natural</u> spread? (p. 31) dd

* Isn't Kegg's study (1972a) one of the worse possible examples of tree mortality due to gypsy moth defoliation? Wasn't the study area used one of the most muneralbe areas (poor, shallow, ridge-top soils)? Can this study be generalized to most usual treatment areas for suppression projects? Isn't the area used for this study now less susceptible to future dramatic defoliations by the pest? What does the area look like now? (p. 32) ee

* Haven't the authors of the EIS taken many of the points cited out of context? Studies such as those by Clements and Monroe and, yes, even Campbell which show that the effects of defoliation by the pest are rarely that dramatic. Certainly Bess et al. came to a completely different conclusion than the authors would have us believe! (p.32) ff

* Are you claiming that frass is more of a pollutant than contact poisons? gg

* Can increase in algae due to frass being washed into waters be compared to that which is experienced by the run-off of lawn chemicals, spraying of pesticides which reduce aquatic life and spillage from faulty septic systems? (p.33) hh

* Are the individuals who would cut down all the trees on their property to avoid the pest or those who feel that the caterpillar is "invading" their homes a substantial reason to spray chemical poisons from the air? (p.33) ii

* Why weren't pesticide poisoning symptoms considered? Certainly they can be more problematic than those experience by people reacting from the hairs on the larvae! (p. 34) jj

* Do caterpillars "invade" homes?. Aren't they much more interested in trees than houseplants? The USDA is getting quite ridiculous! (p. 34) kk

* Calculations for average children weighing 55 pounds do not take into consideration infants and smaller children or children with particular problems or allergies or those people with certain health problems or the old! (p. 37) ll

* How can anyone ever claim that "drift did not occur."? mm

* Is the USDA aware that even leaving an area before spraying takes place and returning later does not allow a person to be free from exposure? According to Dr. Kenneth Rosenmen of New Jersey Department of Health, who is also a member of New Jersey's Governor-appointed Pesticide Control Council, a person will still be exposed if he/she leaves and returns at a later time! (p.48)(p.50) nn

* Where is the mention of Tieshirst, et al. (1982) study entitled, "Effects of reduced rated of dipel 4L, dylox 1.5 oil and dimilin W-25 on Lymantria dispar, parasitism and defoliation." (Environmental Entomology, II: 1058-1062)? Why wasn't parasitism enhancement discussed? Sub-lethal doses of B. t. caused larvae to remain small for a longer period of time resulting in a greater amount of acceptable hosts for a second generation of adult parasites (Cotesia (=apanteles) menanoscelus). Isn't this an additional reason to limit spraying to biologicals? oo

* Why does the USDA insist in using available funds for such back-ward programs which have no long-range answers when such funds should be channelled into biological programs such as beneficial insect rearing and releasing and education of the public on self-help techniques? pp

Nancy Browne Coleman

Nancy B. Coleman
4 Crawford Road
Morris Plains, NJ 07950

FEB 2 4 1984

United States Department of the Interior
FISH AND WILDLIFE SERVICE
75 SPRING STREET, S.W.
ATLANTA, GEORGIA 30303

30

Febraury 22, 1984

Mr. Thomas N. Schenarts, Director
U.S. Forest Service
370 Reed Road
Broomell, PA 19008

Dear Mr. Schenarts:

We have reviewed the Draft Environmental Impact Statement entitled "Gypsy Moth Suppression and Eradication Projects" and have the following comments:

We concur that the implementation of an integrated pest management (IPM) approach is the preferred approach. However, we strongly urge that the IPM approach be slanted as heavily towards the use of biological control as possible with as little use of chemicals as feasible.

We recommend that the use of carbaryl be limited in watershed areas because of its high toxicity for aquatic invertebrates.

In the final EIS, we recommend that you specify formulations when discussing the toxicity of acephate and trichlorfon such as was done for carbaryl in the DEIS.

We question the statement on page 55 that trichlorfon . . . has shown no significant adverse effects against . . . fish. . . . The LC50 of trichlorfon (80 percent soluble powder) ranged from 0.7 to 9.2 parts per million for bluegill and various species of trout. (Johnson, W., and M. T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USDI/FWS, Resource Publication 137. pp. 78-79.)

Thank you for the opportunity to comment on this document.

Sincerely yours,

David B. Allen

David B. Allen
Acting Deputy Regional Director

RCVD. FOSS 2-28-84

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

31

FEB 23 1984

OFFICE OF
EXTERNAL AFFAIRS

Mr. Robert L. Williamson
Director, National Program Planning
Staff, USDA Animal and Plant Health
Inspection Service, Federal Bldg.
Hyattsville, Maryland 20782

Dear Mr. Williamson:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (EIS) for USDA Gypsy Moth Suppression and Eradication Projects.

EPA has rated this draft EIS LO-2 (Lack of Objections/Insufficient Information) a copy of our rating system is enclosed. Based on the information currently available and the identification of Integrated Pest Management (IPM) as the preferred alternative, EPA does not object to the proposed eradication program provided that all appropriate mitigation measures are implemented. However, we believe that greater detail and analysis should be included within the FEIS to enhance the document's usefulness as a decisionmaking tool and to insure that all appropriate mitigation measures are taken. Our comments below identify topics in need of more detailed discussion. Detailed comments on the document are also enclosed.

The draft EIS is a very generalized statement of the eradication program's principles. We believe that the purposes of the document would be better served by inclusion of expanded descriptions of the Animal and Plant Health Inspection Service (APHIS) and the Forest Service (FS) overall programs for suppression and eradication; treatment site selection criteria; treatment method selection criteria; and public notification, awareness, and participation techniques. a

As currently drafted the EIS does not provide a clear description of the suppression and eradication programs, nor is the relationship between the FS and APHIS programs clear. Greater specificity on the elements and requirements of the State/Federal cooperative program would assist the reader in better understanding the scope of the proposed activity. b

The evaluation of alternatives and project impacts could be enhanced by a more detailed description of the management situation. For example, the discussion of the treatment area selection process could be improved by constructing a matrix demonstrating the relationship between factors such as egg mass size, numbers, and viability; previous defoliation history; land use categories; and the treatment decision. Similarily, factors which indicate site characteristics and sensitivities could be displayed with the corresponding treatment methods and mitigation considerations. Finally, detailed guidelines for public notification of eradication activities should be developed for generic treatment environments (suburban, rural, forested, cleared etc.) c

EPA supports the selection of the Integrated Pest Management (IPM) approach as the preferred alternative. This approach provides the greatest flexibility addressing site specific factors. We encourage USDA to vigorously pursue all elements of the IPM approach, not solely the chemical eradication method. d

With respect to the pesticides discussed, we note that all are registered pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for gypsy moth control. None of these chemicals are currently under review for suspected health or environmental hazards posed by their registered uses according to generally accepted application practices. However, we do not accept the statement made in the EIS that Sevin XLR, a formulation of carbaryl, can be considered "relatively non-toxic" to honeybees. Our views on the toxicity of this substance to honeybees is included in our detailed comments. e

Further, we note that recent court rulings have held that a FIFRA registration alone is inadequate to satisfy the requirements of NEPA. In accord with these recent holdings and the regulations implementing NEPA, the EIS must identify "any gaps in relevant information or scientific uncertainty," and "where such information is essential to the reasoned choice among alternatives," the agencies must either obtain the information, or if the costs are exorbitant, should conduct a worst case analysis. (40 CFR 1502.22). We note that APHIS and the FS are currently preparing the analysis required by Section 1502.22. We endorse this decision, noting that adequate time for public review of this analysis must be provided. f

Thank you for the opportunity to comment. Should you have any questions concerning our comments please contact me or Margaret Schneider (382-5070) of my staff.

Sincerely,

Allan Hirsch

Allan Hirsch
Director
Office of Federal Activities

Enclosures

DETAILED COMMENTS:

GYPSY MOTH SUPPRESSION AND ERADICATION PROJECTS

Pesticides

In a discussion of the toxicity of pesticides to honey bees, the DEIS (page 17) cites a publication by the Division of Agricultural Sciences, University of California (Anonymous 1981). It is noted that Sevin XLR is rated as relatively non-toxic to honey bees.

While the University of California publication does list Sevin XLR as relatively non-toxic (page 11), it should be noted that, on page 19 of the same publication, Sevin XLR (misprinted as Sevin SLR) is listed as moderately toxic. In the same table, field test data indicate a moderate hazard to bees for as long as 6 days after treatment. g

In December of 1982, EPA reviewed a number of studies, submitted by Union Carbide in support of revised honey bee Labeling for Sevin XLR. Based on work by Atkins and others, we concluded that Sevin XLR is highly toxic to honey bees exposed to direct application. We also noted, based on the submitted studies, that the residual toxicity of Sevin XLR is highly variable, depending on such factors as weather conditions and type of crop treated. h

In general, it appears that the dried residues of Sevin XLR are less hazardous than those of other carbaryl formulations. Thus, although the bee hazard may be reduced by using this formulation, Sevin XLR should not be considered non-toxic to honey bees. i

Technical Corrections

- Page 2, the University of California publication authors are E. L. Atkins, D. Kellum, and K. W. Atkins. The citation should be changed accordingly. j
- Please add to Bibliography: Hayes, W.J. Jr. 1980. Pesticides Studied in Man. Williams & Wilkins Co.; Baltimore and London. ISBN 0-683-03896-6. k
- When discussing each pesticide, we suggest you begin by providing the exact chemical name, not just the trade name. l
- Page 34 - corticosteroids is misspelled on Line 7. m

- Page 42 - We suggest that broad statements such as "The use of carbaryl has no direct adverse effects on amphibians or reptiles or fish" should be modified. ("The registered use of," or a similar modifier should be inserted). The statement is misleading as written. n

- Page 43 - Last line. "Nerve Poisoning" could be better stated by the terms "parasympathetic stimulation." o

- Page 47 - The reference to personal communication, Dr. Sandifer, should be included in the bibliography. p

- Page 51 and elsewhere - Carbaryl has also been used in marine and estuarine environments to control crustaceans which compete with oyster farming. Perhaps you may wish to include some brief references to aquatic effects of carbaryl as part of their overall discussion on toxicology and environmental effects. q

- Page 53 - Last paragraph. More mention might be made of the types of dermal effects testing which were conducted. Were these the standard rabbit eye and skin assays? Other species? Line 14. Arthropods is misspelled. r

- Page 53 - Additional information about ecologic effects of diflubenzuron should include a discussion of its effects on non-target chitin producers other than insects. Fungi in particular produce chitin as well, and are important to the affected environment. What are the likely consequences to these organisms following widespread use of a chitin synthetase inhibitor? s

- Page 54 - Are any chronic effects toxicity data available for diflubenzuron? t

- Page 55 - Again, we suggest that the broad opening statement of Paragraph 3 be modified. (e.g. - "when used in accordance with the label," etc.) As currently written, the statement is misleading. u

- Page 86 - References to milligram as Mg should actually be written mg. v

Water Quality

As discussed earlier, the EIS should contain more detailed guidelines for site selection, treatment method selection, and mitigation measures. In particular we are concerned about the possible effects of eradication programs on water bodies. We suggest that the FEIS discuss the program's compliance with water quality standards, including beneficial uses such as domestic water supply, agricultural uses, the protection and propagation of fish, shellfish, wildlife, protection of waters officially identified as unique or critical habitat for threatened or endangered species, etc. Guidelines for a mitigation strategy (including monitoring) to diminish any adverse water quality impacts, as well as impacts to associated water-dependent natural resources, should be developed. w

Treatment Alternatives

Table 1 on page 3 presents data which describes the growth and spreading of gypsy moth populations. It demonstrates a cyclic pattern in population size, yet it appears that the density of the population does not fluctuate out of sequence throughout the infested area. Have these patterns, the parasite population, the ecological system and other factors been examined in an effort to develop a predictive model which could guide the selection of a treatment method? x

The EIS mentions windows in regard to the limitations of biological treatment methods. This discussion should also reference the fact that often biological treatment can have a longer half life and therefore may not depend as heavily on weather conditions as the chemical approach. y

FEB 2 7 1984

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service 32

Centers for Disease Control
Atlanta GA 30333

February 23, 1984

Mr. Thomas N. Schenarts
Area Director
USDA Forest Service
370 Reed Road
Broomall, Pennsylvania 19008

Dear Mr. Schenarts:

We have reviewed the Draft Environmental Impact Statement (EIS) for the Gypsy Moth Suppression and Eradication Projects. We are responding on behalf of the Public Health Service and offer these comments for your consideration.

The use of the chemical insecticide "carbaryl" as a component of the Integrated Pest Management (IPM) strategy has been discussed at length in the Draft EIS. The concerns related to potential health risk from direct and indirect exposure to this and other pesticides were adequately addressed based on the current data bases. As stated in the Carbaryl Decision Document, December 1980, Office of Pesticides and Toxic Substances, Environmental Protection Agency (Appendix D), consideration must be given to any additional data on the effects of carbaryl as it becomes available.

The Final EIS should provide specific safety plan information. This discussion should include contingency plans for pesticide spills and worker exposures, as well as protective clothing requirements and safety procedures to be used. What training will these individuals who actually mix and apply the pesticides receive? Has consideration been given to biological monitoring of these workers, e.g., serum cholinesterase levels? a

We support the preferred IPM alternative of the USDA Forest Service and Animal and Plant Health Inspection Service for gypsy moth suppression. This IPM approach, when properly balanced, provides the program with the least environmental impacts.

Thank you for the opportunity to review this document. We would appreciate receiving a copy of the Final EIS when it is available. If you have any questions about our comments, please contact Mrs. Gailya P. Walter of our staff at FTS 236-4161.

Sincerely yours,

Joe H. Miller

Joe H. Miller
Acting Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

[?]. FOSS 2-24-84

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE

1220 N Street
Sacramento
95814

33

February 23, 1984

Mr. Robert L. Williamson, Director
National Program Planning Staff
USDA Animal and Plant Health
Inspection Service
Federal Building
Hyattsville, Maryland 20782

Dear Mr. Williamson

We have reviewed the 1984 Draft Environmental Impact Statement for Gypsy Moth Suppression and Eradication Projects and support the selection of integrated pest management as the preferred approach for gypsy moth suppression and control. We support the development of non-chemical eradication tools and encourage increased federal participation in regulatory activities.

We feel that the document should define the criteria used in deciding whether the goal of a project is suppression or eradication. The document should also include a definite statement of the set of circumstances which would trigger federal participation in local gypsy moth eradication projects. a

We strongly encourage an expanded research effort on the part of the USDA to develop a database on the efficacy of high potency Bacillus thuringiensis (B.t.) formulations for eradicating gypsy moth under controlled and reproducible experimental conditions. The inclusion of carbaryl or Dimilin as a standard in determining the relative efficacy of B.t. in such research trials would be desirable. b

Thank you.

Sincerely

I A Siddiqui

Isi A. Siddiqui, Chief
Pest Detection/Emergency Projects
Division of Plant Industry
(916) 324-3761

cc R. Magee, Division of Plant Industry, CDFA

FEB 27 1984

34

W2TC Western Washington Toxics Coalition
4512 University Way N.E.
Seattle, WA. 98105
(206) 633-1666

February 23, 1984

The following are the comments of the Western Washington Toxics Coalition on the "Gypsy Moth Suppression and Eradication Projects" Draft Environmental Impact Statement.

A. It is a problem throughout this DEIS that there is no clear distinction made between the two rather different gypsy moth 'problems': a
a) large, well-established infestations,
b) small, isolated infestations.
For each of these situations, the goals, concerns, and effects of alternatives are substantially different. The discussion would be less confusing and misleading if these 'problems' were separated in each section (the section on Environmental Consequences of No Action, P.32-37, provides a relatively good example).

Some instances of confusion are as follows:
a) the goal of eradication is not the same as the goal of suppression. These goals need to be separately justified, and the best means of achieving them separately evaluated.
b) concerns such as 'defoliation' and 'larval nuisance' are irrelevant in areas with small isolated infestations; and the concern that the gypsy moth population will become well established is irrelevant in areas with permanent heavy infestations. The discussion of the various alternatives and their environmental consequences should explicitly distinguish the different concerns. b

B. We are pleased to see that Integrated Pest Management (IPM) is the preferred alternative. However, a clear definition of exactly what is meant by IPM is needed, and the decision-making criteria to be followed in future site-specific EA's need to be explicitly laid out. At present much of the language gives the impression that IPM is understood as a random hodge-podge of a variety of control components all used at once.

A standard definition of IPM is as follows:
IPM is a process for deciding IF suppression treatments are needed, WHEN they should be intitated, WHERE they should be applied, and WHAT strategy and mix of tactics to use. This approach involves monitoring to determine injury and action levels, and the selection of treatments THAT ARE LEAST DISRUPTIVE TO NATURAL CONTROLS, AND LEAST HAZARDOUS TO HUMAN HEALTH AND THE ENVIRONMENT.

Many of the components of a proper IPM program are ignored in this DEIS, (for example, monitoring and determination of action levels), and there is no indication of the process to be followed in determining which strategy and mix

of tactics is most appropriate if it is determined that treatment is necessary.

The conclusion on P.21 that IPM will perform less effectively than chemical insecticides and better than biological insecticides in terms of population reduction is illogical and not supported by any facts. Such a statement reflects an unsupported pro-chemical bias, and ignores evidence of the success of biological insecticide programs. It should be amended to reflect available evidence.

C. The section on environmental consequences of chemical insecticides is seriously inadequate.

a) NEPA requires that data gaps and scientific uncertainty with regard to any particular action be identified. This has not been done with regard to the health effects of chemical insecticides. EPA can provide a list of data gaps in health and safety testing for each of the insecticides discussed. Health and safety data that are unavailable for public review due to trade secrets claims should also be identified. C a

b) There is no justification for the conclusion that no evidence of harm means evidence of safety. The truth is that in many instances there is no evidence one way or the other, and therefore no conclusion at all is warranted. For example, the toxicological evaluations of acephate and diflubenzuron contain nothing about possible chronic health effects. Thus the final paragraphs on P.39 and P.54: "It is highly unlikely the use of acephate (diflubenzuron)......would pose any human health hazard" are irresponsibly inaccurate. At the very least they should read that use is unlikely to pose any ACUTE human health hazard. And a sentence should be added to the effect that the potential chronic health hazard is unknown.(N.B. Low acute toxicity does not necessarily mean low potential for causing chronic effects.) C b

c) It was interesting to note that while the LOW acute toxicities of carbaryl's metabolites are included (P.42), the HIGH acute toxicity to birds and mammals of acephate's metabolite methamidophos is omitted (P.38). This gives the unfortunate appearance that material is being selectively presented to minimize any possible concerns about chemicals. C c

d) There is no mention of the fact that acephate was found to be mutagenic in the same studies (referred to on P.56) that found trichlorfon to be a suspected mutagen. C d

e) EPA registration of pesticides is not based on a determination of safety, and neither does EPA withhold registration for lack of data. Therefore, the fact that EPA chose to impose no further restrictions on carbaryl products (P.51), has no bearing on the conclusion that the use of carbaryl is unlikely to pose a human health hazard. In fact, the evidence presented suggests that carbaryl may well cause adverse human health effects. Again, where information is unavailable, where there are data gaps, or where there is scientific uncertainty, NEPA requires that a worst case analysis be done. This should be done for all the treatment options considered in the DEIS. At the moment only the No Action alternative contains anything like a worst case analysis - such as: a) the problems caused by peoples' "natural fear of insects" (what about peoples' natural fear of poisons?), and b) the "expectation" (P.35) that in isolated infestations gypsy moth populations will thrive and become well established. In fact, in certain ecosystems, such as C e

the Pacific Northwest, there is no evidence one way or the other as to whether the population will thrive or die out, so eradication treatments are based on the worst case assumption that it will thrive.

D. Although the toxicological evaluations of the chemical insecticides are incomplete, the evidence as it is presented makes it clear that the biological insecticides pose a much lower threat to environmental as well as human well-being. Thus the last sentence in the second to last paragraph on P.19 should read "The biological insecticide treatment alternative best minimizes adverse impact on soil, air, and water, as well as on human and environmental health." d

E. We see no reason for the conclusion on P.20 (last paragraph) that the biological insecticide alternative is only justified "where special environmental concerns have been identified". Rather, it would seem to be justified under almost all circumstances, given its efficacy, economic efficiency and low adverse impact on the environment. The only situation where other alternatives might be considered is when IMMEDIATE reduction in larval population (to reduce larval nuisance, and protect host foliage) is determined to be MORE important than the potential adverse impacts on the environment of other options. e
The statement that "the biological insecticide alternative would be justified where...absolute...reduction in gypsy moth populations are not required" suggests that efficacy leaves something to be desired. This is not supported by the information presented in the earlier paragraphs, nor by the experiences with B.t. during 1983 in Washington state, which showed it to be as effective an eradication tool as chemical insecticides. Inclusion of post-treatment trapping data from Washington, Oregon and California for 1982 and 1983 eradication programs would prove this point.

In general this DEIS needs substantial revisions, specifically with regard to:
a) defining IPM, and presenting an adequate outline of the IPM decision-making process to be followed with regard to implementing an IPM program;
b) providing a more complete and accurate presentation of the available and unavailable evidence with regard to the efficacy of each option, and the potential impacts of each option.

Christine Luboff

Christine Luboff
Western Washington Toxics Coalition
Regional Coordinator

FEB 27 1984

AUDUBON NATURALIST SOCIETY
OF THE CENTRAL ATLANTIC STATES, INC.

Founded May 18, 1897

CONSERVATION
ENVIRONMENTAL EDUCATION
NATURAL SCIENCE STUDIES

February 23, 1984

Thomas N. Schenarts, Area Director
USDA Forest Service
370 Reed Rd
Broomall, PA 19008

Dear Mr. Schenarts:

The Audubon Naturalist Society of the Central Atlantic States, Inc. and the Rachel Carson Council, Inc. are pleased to submit comments on U.S. Forest Service Gypsy Moth Suppression projects as outlined in the Draft Environmental Impact Statement.

In general, both the Society and the Council support an Integrated Pest Management approach to Gypsy Moth Suppression plans. We define Integrated Pest Management to be suppression treatments made only when and where monitoring has indicated that the pest will cause unacceptable economic, medical or aesthetic damage. Treatments are chosen and times to be most effective and least disruptive to natural mortality factors. Essentially, IPM is an intervention strategy that seeks to harmonize the relationship between human beings and other species regarded as pests. We strongly urge the Bacillus thuringiensis (Bt) be used as the control material in publicly funded suppression programs. Bt addresses both concerns in gypsy moth programs--the need for foliage protection--and the need for public safety. a

In support of an Integrated Pest Management approach to Gypsy Moth suppression we offer the following rationale.

First, chemical insecticides have not worked to eradicate the gypsy moth nor prevent its spread. "The History of Gypsy Moth Control", (pp. 4-8) adequately addresses the long, unsuccessful use of chemicals. In fact, there is evidence that using chemical insecticides will pre-empt natural controls, reduce predation, parasitism, and disease, and actually prolong outbreaks (Environment 13(6):10-18, Ian Nisbet, 1971). b

Second, the Economic Considerations (p.11) in the DEIS contain information which could mislead readers, especially the figures on losses. It is well documented that the fate of a defoliated tree is determined primarily by its condition at time of defoliation and by the number of consecutive years it is defoliated (The Gypsy Moth Research Toward Integrated Pest Management, USDA, 1981). No information is provided to describe the condition of the oaks growing in the Stokes State Forest in New Jersey. How many years of severe defoliation occurred? What types of control action took place between 1975 and 1978? What other factors contributed to the mortality rates? It is c

8940 Jones Mill Road • Chevy Chase, MD 20815 • Headquarters Telephone: 301-652-9188

also well documented that few healthy hardwoods will die from a single gypsy moth defoliation (ibid, p. 288).

Third, we maintain that no chemical insecticide comes with adequate safeguards for public health and environmental safety. Chemical insecticides should be considered only as a last resort after cultural and biological methods of control are used and evaluated. d

Finally, the USDA does not seem to have enough information yet to implement a thorough IPM gypsy moth suppression project. The five-year pilot project to evaluate IPM as a means of accomplishing forest resource protection against the gypsy moth in Maryland began in 1983. The results of that pilot project are needed before information about beneficial synergistic relationships between Bt and parasites, the success of pheromone trapping, and forest stand modification in this region is known and can be applied. e

In the meantime, conservative measures--collecting of egg cases, using Bt only in known infected areas, and encouragement of parasites and predators can continue-- the least hazardous and probably most effective approach. f

I have taken the liberty to enclose The Gypsy Moth Kit co-published by the Rachel Carson Council Inc. and the Audubon Naturalist Society. We use the kit to help educate the public about the biology of the moth, its effects, and the hazards and effectiveness of control methods.

Sincerely,

Neal Fitzpatrick

Neal Fitzpatrick
Environmental Education Coordinator
Audubon Naturalist Society

Shirley Briggs

Shirley Briggs
Executive Director
Rachel Carson Council

NF:ksd

NEW JERSEY COALITION FOR ALTERNATIVES TO PESTICIDES
P.O. BOX 627
BOONTON, NEW JERSEY 07005
(201) 334-7975

FEB 2 7 1984

February 23, 1984

Thomas Schenarts, Area Director
USDA Forest Service
370 Reed Rd.
Broomall, PA 19008

Re: GYPSY MOTH SUPPRESSION PROJECT - 1984 DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Mr. Schenarts:

New Jersey Coalition for Alternatives to Pesticides (NJCAP) was formed in response to the public's growing concern over the misuse and health and environmental effects of pesticides. We appreciate the opportunity to comment on the 1984 Draft Environmental Impact Statement for the Gypsy Moth Suppression and Eradication Project. The comments we provide address statements in the EIS as denoted by page number.

p. v The EIS states that there appears to be no substantiated medical evidence showing that the chemical insecticides as used in the gypsy moth project have a significant adverse impact on human health when used according to pesticide label, except where individuals exhibit extreme sensitivity.

OUR COMMENTS: Will you define "significant" adverse impact? The reasons that there may be no substantiated medical evidence is not because there are no ill effects as a result of chemical usage but because there is no mandatory pesticide reporting system (except for the state of California, we believe). This fact should be noted in future EIS's. a

p. v The EIS states that "chemical insecticides used for gypsy moth suppression...projects have a relatively short residual life in soil and water."

OUR COMMENTS: We refer to a report on carbaryl (Sevin).[1]

> Carbaryl does not present problems for persistence or accumulation in water, soils or sediments. In each of these media, however, studies have shown that some carbaryl residue can be identified after relatively long periods of time (six months to one year), indicating that carbaryl molecules can persist once they b

---

[1] Dolinger, Peter and William Fitch, Carbaryl Monograph Number One - Environmental Health Evaluations of California Restricted Insecticides, p. Ca-1 (Summary and Conclusions), Peter Dolinger Associates, Chemical Regulatory Consultants Menlo Park, California.

are localized or bound in non-reactive micro-environments. A similar situation exists for carbaryl metabolites and their conjugates. Biological activity of bound and conjugated residues is likely to be lower than that of the parent compound.

p. v The EIS states that 2 or more applications of Bt may be required to achieve project objectives where gypsy moth populations are extremely high or...

OUR COMMENTS: Could the project objectives be higher than necessary to prevent tree mortality? Is the project objective more concerned with aesthetics than preventing tree mortality? Couldn't a lower project objective still prevent tree mortality? c

p. v The EIS states that with the use of Bt, larval mortality does not occur rapidly and that larval nuisance and tree defoliation are likely to continue for several weeks after application.

OUR COMMENTS: Do you have studies to back this statement? According to Abbott Laboratories (one of the manufacturers of Bt), their formulation of Bt known as Dipel will result in the insects death within one to four days, depending on the species and environmental conditions. Even if the caterpillar does not die quickly, there will be a lack of feeding. This information is from Abbott Laboratories technical manual on Dipel. d

p. 3 The EIS provides a table of gypsy moth defoliation from 1924 to 1983.

OUR COMMENTS: Define defoliation -- is this light, moderate or heavy defoliation? Did the trees die? Did the trees refoliate? The way the table is described, it sounds as though all those acres were destroyed by gypsy moths. Tables such as these without adequate explanation of the degree of defoliation has caused many municipalities to be alarmed. In some cases, municipalities have sprayed entire towns even though the entire area did not need to be sprayed according to NJ Department of Agriculture officials. NJ DOA press releases have upset people needlessly and as a result some contract for ground spraying even when aerial spraying is going to be done as part of the DOA gypsy moth spray project. e

p. 15 The EIS states that parasite and predator management has not demonstrated the effectiveness necessary for meeting gypsy moth suppression and eradication objectives.

OUR COMMENTS: On what basis, do you make this statement? Do you have studies to support the statement? Are parasites and predators not working as well as to be expected because chemicals used in gypsy moth suppression projects interfere in their effectiveness by reducing their numbers? f

p. 16 The EIS states that project objectives for chemicals is a minimum of 70% host foliage protection and a 90% reduction in the number of larvae present and residual egg masses.

<u>OUR COMMENTS</u>: How was this project objective for chemicals determined? Is the 90% reduction in the number of larvae really necessary to prevent tree mortality or could a lower reduction in the number of larvae prevent tree mortality? Does aesthetics enter into your determination of project objective? g

p. 20 The EIS states that it generally takes 7 to 10 days before larvae die when Bt is applied.

<u>OUR COMMENTS</u>: Refer to our second page of comments in which it has been shown that insects die within one to four days, depending on species and environmental conditions. h

p. 21 The EIS states that in areas where parasites or other natural controls are exerting adequate biological pressure on gypsy moth populations, these areas probably would not receive insecticide treatment.

<u>OUR COMMENTS</u>: Why the word "probably"? Why would an area, where natural controls are adequate to control the pest, be sprayed? i

p. 22 The EIS states that persons living within the treatment area will be notified.

<u>OUR COMMENTS</u>: If the notice is by newspaper, then this is not adequate notification. Personal letter is the only adequate way of notifying. In addition, why aren't people living on the <u>edges of target areas</u> notified? Beekeepers adjacent to the target area are notified. US EPA studies indicate that there is considerable amount of drift when pesticides are aerially applied.-- the pesticide can travel as far as 1,000 feet from the target site. Will the people being notified have the right to know what pesticides are being applied and the precautions that appear on the label as well as any other precautions necessary to minimize exposure? j

p. 23 The EIS states that local residents decide whether or not to participate in a gypsy moth suppression project.

<u>OUR COMMENTS</u>: It would be better to say that town councils decide whether to participate in the spray program. Two municipalities of which we are aware had a poll to determine what pesticide, Bt or Sevin, should be used. Although the majority of residents chose the biological pesticide in both of these municipalities, the town councils in each of these towns voted for the chemical insecticide. k

p. 24 The EIS states that treatment area selection criteria are similar for projects on Federal lands.

OUR COMMENTS: Doesn't former President Carter's Executive Order require that only biological pesticides be used on Federal lands. Does this Executive Order still apply or has it been rescinded by President Reagan. l

p. 24 Single engine aircraft can be used for aerial applications.

OUR COMMENTS: NJCAP objects to the use of single engine aircraft over residential areas due to the danger involved. m

p. 24 The EIS states that observer planes can be used to direct the aerial applicators to the treatment areas... to notify pilots of exclusion areas...

OUR COMMENTS: Why aren't observer planes required in all cases? n

p. 24 According to Federal Aviation Agency regulations, low level flying is prohibited in certain areas, but waivers can be sought from this regulation.

OUR COMMENTS: In what types of areas are low-level applications prohibited according to FAA regulations? Can you cite the statute and regulation for our information? Have you obtained waivers in order to spray certain areas in the past? What are the criteria to obtain waivers? o

p. 25 If necessary, treatment areas can be designated with helium-filled balloons.

OUR COMMENTS: When is it necessary? If observer planes and helium filled weather balloons are not mandatory, is the pilot relied upon for accurate deposition of the insecticide in the target area? If the pilot applies it to a non-target area, what is the penalty? p

p. 25 The EIS states that treatment will be suspended whenever the insecticides do not appear to be settling in the target area.

OUR COMMENTS: Who determines when treatment will be suspended? q

p. 25 The EIS states that most insecticide treatments are applied in the early morning-4:30 am to 10 am...

OUR COMMENTS: How will school children walking to school or waiting for school buses be protected from the aerial application? NJCAP has had many complaints about children being sprayed by aircraft while waiting for school buses and walking to school. r

p. 26 The EIS states that where aerial application of insecticides is not appropriate ground equipment may be used.

OUR COMMENTS: When would aerial application not be appropriate? Have there been cases where ground equipment was utilized during a gypsy moth suppression spray program? s

p. 26 Beekeepers are notified whether they are in or adjacent to treatment areas.

OUR COMMENTS: NJCAP agrees that beekeepers in or adjacent to treatment areas must be notified. How do you define adjacent? Pollen traps are available, but beekeepers have informed NJCAP that they are ineffective. Why does DOA feel pollen traps to be effective? The problems of moving hives should be addressed in the EIS as this is the method used by some beekeepers to avoid bee kills due to chemicals. Other beekeeps have told NJCAP that due to the weight of hives they would be impossible to move. Have you considered the number of bees killed by pesticides (chemical)? Is there a place where beekeepers can register their complaints? t

p. 26 Egg mass surveys can be requested by local governments.

OUR COMMENTS: Why aren't egg masses required to be monitored for winter survival and the effect of parasites and predators to determine if treatment is warranted? u

p. 27 The EIS states that summer aerial defoliation estimates will be conducted statewide.

OUR COMMENTS: Are these aerial defoliation surveys conducted late enough in the summer in order to assess how much refoliation occurred? v

p. 27 The EIS states that in the fall, egg mass counts are conducted in selected areas to measure population reduction.

OUR COMMENTS: What are the criteria used to select areas for egg mass counts in the fall? w

p. 30 The EIS states that ...infested sites may range from generally open areas occupied with shrubs and those with occasional ornamental trees to highly forested communities or...

OUR COMMENTS: Are generally open areas occupied with shrubs and those with occasional ornamental trees targeted for spraying by the DOA? If yes, why? A lawn with a few scattered trees should not be considered a target area, but it becomes part of the target area when aerial application of such areas takes place. Pennsylvania guidelines state that areas such as these are the responsibility of the homeowner x

and cannot be included in the gypsy moth spray program of the state.

p. 30 The EIS states that since the goal of the project is eradication, individuals do not have the option of having their property excluded from treatment.

<u>OUR COMMENTS</u>: By what statutory authority does the DOA have the right to chemically tresspass on an objector's property? Can't DOA give an objector the right to have the property excluded or require that the property be taken care of by cultural and/or biological methods? These cultural and biological methods would achieve the same results as chemical treatment. y

p. 32 The EIS cites Kegg's study in which 2 years of heavy defoliation in northern NJ in 1969 and 1970 killed 63% of the oaks in the study area.

<u>OUR COMMENTS</u>: NJCAP objects to the DOA singling out a study which involved an area of poor soils and ridgetops which are more susceptible to death from gypsy moths than most areas. An area of Jockey Hollow National Park has utilized non-chemical methods of control for approximately 14 years with success. z

p. 32 There are many assumptions listed on this page. For example, the EIS states that there may be increased streamflow and lowered water quality as a result of death of trees.

<u>OUR COMMENTS</u>: If NJCAP made such assumptions about pesticides, we would be severely criticized. Please provide proper studies to support statements in the EIS. The opponents of pesticides want to see <u>documented</u> cases of illness before they say pesticides are unsafe. NJCAP asks that all statements be supported by scientific evidence. aa

p. 32 The EIS states that hairs on gypsy moth larvae cause skin rashes and welts.

<u>OUR COMMENTS</u>: Has it been sufficiently determined that the hairs on gypsy moth larvae are the problem? Could the chemical residues on the caterpillars also cause skin rashes and welts? bb

p. 34 <u>OUR COMMENTS</u>: The EIS provides a scenario in which people are emotionally affected by crawling caterpillars. NJCAP thinks in all fairness that another scenario be provided which depicts the time, inconvenience and expense necessary for people to protect themselves from exposure to pesticides. For example, many physicians are warning pregnant women to avoid exposure to chemical insecticides and are instructing them to leave the area prior to the spraying. These women must bear considerable expense and inconvenience to find other places to live while the aerial application is taking place as well as for some time after the application. A representative of the NJ Dept. of Health has stated that you can become exposed to chemical insecticides even after the spraying. Many women arrive back home to find that the spraying had been postponed due cc

to weather conditions. People have to cover vegetable gardens. Many organic gardens have been contaminated by the aerial application of pesticides. The public has such non-target areas as lawns contaminated in which they do not feel comfortable allowing children and pets to play on for some time.

NJCAP has ~~many~~ letters from people who have exhibited symptoms of pesticide poisoning after being exposed to chemical pesticides applied aerially. Children as young as infants and two years old have had symptoms of pesticide poisoning. We have letters from people who wanted their properties ~~to be~~ sprayed aerially with chemicals and who have exhibted signs of pesticide poisoning. Pesticides do have a mental and physiological effect on people. Because there is no mandatory pesticide reporting system in New Jersey, many cases of pesticide poisonings go unrecognized and unreported.

In addition, for most pesticides there have been tolerance levels (so called "safe" levels of pesticides allowed on foods) established by EPA. (The public is losing confidence in EPA's ability to protect them from toxic substances.) Sevin 4 Oil, for example, which is <u>not</u> intended for food crops is used for aerial application against gypsy moths. If Sevin 4 Oil contaminates your vegetable garden, how long should you wait before harvesting it for consumption?

p. 36 The EIS states that "suppression activities undertaken by individuals or communities without the benefit of coordination with a Federal/State administered program may result in application of more insecticide than is necessary".

<u>OUR COMMENTS</u>: NJCAP has found that some of the people that have had their properties aerially sprayed also contract with ground applicators. We have found that NJ DOA press releases have alarmed people unnecessarily. There may be less spraying when there is no state gypsy moth suppression program. Many of the properties that were aerially sprayed against their wishes ~~may~~ will not contract with ground sprayers. Unfortunately, pesticide spray companies have influenced people to spray whether they needed spraying or not. Some companies at present are advertising that a minimum of two sprays are necessary to control gypsy moths even though the part of the state in which they are advertising is not having a problem with gypsy moths. **dd**

p. 37 The EIS states that those people who exhibit symptoms of pesticide poisoning are "abnormally sensitive".

<u>OUR COMMENTS</u>: Since we do not know the long-term effects of pesticides, we can't say that those people who do not exhibit immediate (acute) symptoms are not sensitive. Perhaps more people are becoming more sensitive due to the multitude of chemicals to which they are exposed. **ee**

p. 41 <u>OUR COMMENTS</u>: The EIS fails to mention~~s~~ that 1-naphthol is more toxic to mollusks and fishes than the **ff**

parent compound, carbaryl.[2]

p. 42 The EIS states that "the use of carbaryl has no direct adverse effects on amphibians or reptiles or fish".

<u>OUR COMMENTS</u>: What do you mean by "direct"? There have been considerable studies to show that carbaryl is toxic to certain species of fish. gg

p. 44 The EIS states that Harry compiled an extensive review of human exposure to carbaryl. "Despite almost universal exposure in the US over more than 20 years it seems that the safety record of carbaryl is almost unparalled by any other insecticide."

<u>OUR COMMENTS</u>: There is no mandatory pesticide reporting system (except for state of California). Many cases of pesticide illness go unrecognized and unreported. It should be reported that Sevin has caused mutations in lab studies. According to EPA's "Carbaryl Decision Document" (1980), there were sperm abnormalities in male workers who were exposed to Sevin. EPA feels that these results are just suggestive and that it must be established that these defects are not the result of exposure to chemicals other than Sevin, yet EPA does not request that such a study be done. It should also be reported in future EIS's that Sevin 4 Oil depressed the formation of antibodies when fed to rabbits at low doses.[3] Antibody production is the means by which the body fights bacterial infection. hh

p. 52 Why does EPA restrict the use of Dimilin 25W to forested areas with one house or less per 10 acres? ii

p. 62 Future EIS's should contain the following information: Bt caused reduction in larval density and retarded development of the residual larval populations with the result that there was increased parasitism by <u>Cotesia</u> (= <u>Apanteles</u>) <u>melanoscelus</u>.[4] jj

---

[2] Stewart, N. et al., 1967. Acute Toxicity of the Insecticide Sevin and Its Hydrolytic Product 1-Naphthol to Some Marine Organisms. Trans. Am. Fish Soc. 96:24-30.

[3] US Dept. of Agriculture, 1974 Final Environmental Impact Statement on Cooperative Gypsy Moth Suppression and Regulatory Program.

[4] Andreadis, T. et al. Dec. 1983, Single Applications of High Concentration of Bacillus thuringiensis for Control of Gypsy Moth Populations and Their Impact on Parasitism and Disease, J. Econ. Entomol. 76:1417-1422.

Enhanced parasitism by C. melanoscelus has been observed in other studies where Bt was used. This appears to be due to the growth retarding effects of the bacterium which cause the larvae to remain small for a longer period of time when they ingest sublethal doses. Thus, there will be a greater amount of acceptable hosts for second generation adult C. melanoscelus in early to mid June.[5]

p. 63 The EIS should present the costs of releasing species of parasites that are known to be established and how much money is wasted when chemicals are chosen over biological methods of control in areas where the parasites are released and/or breeding. **kk**

We appreciate the opportunity to comment on the Draft EIS. Please include our comments in the Final EIS. NJCAP would like to go on record as stating that we are opposed to aerial application of broad-spectrum pesticides on non-agricultural land. The Department of Agriculture has been claiming that they utilize an integrated pest management approach to controlling gypsy moths. There is no place for a chemical in an IPM program. In addition, it seems both economically and ecologically unwise to use chemical pesticides that disrupt the balance of nature and kill the very parasites and predators that your Department is spending millions of dollars to rear and release.

when you have an effective biological alternative,

Sincerely,

Susan Shaw

Susan Shaw

[5]Ticehurst, et al. 1982 Effects of reduced rates of dipel 4L, dylox 1.5 oil and dimilin W-25 on Lymantria dispar, parasitism and defoliation Environ. Entomol. 11: 1058 - 1062 cited in Andreadis, Ibid.

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
155 Cottage St NE , Salem, Oregon , 97310
Phone Number: 378-3732

PNRS STATE REVIEW

Project #: OR 840151-072-4 Return Date: MAR 09 1984

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the review date.

ENVIRONMENTAL IMPACT REVIEW
DRAFT STATEMENT

( ) This project has no significant environmental impact.

(X) The environmental impact is adequately described. See remarks

( ) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.

( ) No comment.

Remarks

The Statement is technically good from the national and scientific viewpoint. However to be more useful, I recommend that Statements and/or Amendments be prepared to cover site specific areas, i.e. western Oregon.

I also recommend that an economic analysis be made (benefit-cost ratio, present net worth) on at least the preferred alternative in each localized area where action is recommended.

Agency Forestry By LeRoy N. Kline

LeRoy N. Kline, Director
Insect and Disease Management

PNRS #8

JOHN SPELLMAN
Governor

M. KEITH ELLIS
Director

38

STATE OF WASHINGTON
DEPARTMENT OF AGRICULTURE
406 General Administration Bldg., AX-41 • Olympia, Washington 98504 • (206) 753-5063

February 24, 1984

Robert L. Williamson, Director
National Program Planning Staff
USDA, APHIS
Federal Building
Hyattsville, MD 20782

Re: **Draft Environmental Impact Statement - USDA Gypsy Moth Suppression and Eradication Projects**

Dear Mr. Williamson:

On page 19, paragraph 5, the statement is made that "younger larvae (1st to 3rd instar) are much more susceptible to the biological insecticides than are older larvae (4th instar and beyond)..." While this is generally true, I believe that the situation should be further elucidated. First instar larvae are not particularly susceptible to B.t.; it is highly unlikely that the miniscule amount of feeding they do would be sufficient for them to acquire a lethal dose of the bacterium. The repellent characteristic of B.t., and also the tendency for first instar larvae to feed on the undersurface of the foliage also work against B.t. being efficacious when targeted for use on this instar. This problem would be magnified if B.t. were being considered for spot ground application, rather than aerial. a

For clarity's sake, I feel it should be stated that B.t. is primarily efficacious against second and third instar larvae, although it may prove lethal to some younger and older instars (in fact, higher potency applications of B.t. are showing good efficacy against fourth instars). I feel it should also be stated that broad aerial applications, and small, individual property ground applications may elicit differential efficacies, particularly when considering B.t. repellency and probable increased first instar dispersal. While it is unlikely that a first instar larva would disperse far enough to escape an aerial B.t. application, its not improbable that the larva could escape spot, ground applications.

Thank you.

CHEMICAL AND PLANT DIVISION

Judith Freeman

JUDITH FREEMAN, Ph.D.
Entomologist, Special Projects

JF/dla
cc: Mike Schwisow

☆U.S. GOVERNMENT PRINTING OFFICE: 1984-707455/A0152